OPERATING MANUAL

FOR

LT1200X SERIES
POWER SUPPLY

LT1200X MODELS WITH SMART INTERFACE.

Table Of Contents

1. INTRODUCTION 6

1.1. TWO YEAR NEW PRODUCT WARRANTY 6

1.2. CONTACT INFORMATION 7

2. SAFETY PRECAUTIONS 8

3. FUNCTIONAL OVERVIEW 10

4. PRODUCT SPECIFICATIONS 12

5. INSTALLATION INSTRUCTIONS 15

5.1. POWER INPUT 15

5.1.1. Input Power Requirements 15

5.1.2. Input Power Connection 15

5.2. MOUNTING 15

5.3. OUTPUT POWER CONNECTIONS 16

5.4. INHIBIT SIGNAL CONNECTION 16

5.5. SERIAL HOST PORT CONNECTIONS 16

5.6. ANALOG CARD CONNECTIONS (OPTIONAL 138-0471-XX CARD) 17

6. OPERATING PROCEDURES 21

6.1. FRONT PANEL CONTROLS 21

6.1.1. Displays 21

6.1.2. Encoder Functionality 21

6.1.3. Voltage Indicator 22

6.1.4. Current (Amps) Indicator 22

6.1.5. Operate / Standby Switch 22

6.1.6. Remote / Local Switch 23

6.1.7. Inhibit Lamp 23

6.1.8. Fault Lamp 23

6.1.9. Over Temperature Lamp 23

6.2. MENU OVERVIEW 25

6.2.1. Menu Organization 25

6.2.2. Menu Access 28

6.2.3. Menu Navigation 28

6.3. UNIT CONFIGURATION 29

6.3.1. Totalizer Configuration 29

6.3.2. Host Port Configuration 31

6.3.3. Remote Control Configuration 32

6.3.4. Power On Configuration 33

6.3.5. Power Fail Alarm Configuration 34

6.3.6. Remote Operate/Standby Control (Digital Input) 35

6.3.7. Front Panel Button Lock Outs *37*
6.3.8. Hardware Options Configuration *38*
6.3.9. Changing the Unit Configuration Password *38*
6.3.10. Setting Unit Defaults *39*
6.4. CYCLE CONTROL SETTINGS 40
6.4.1. Manual Cycle Control *40*
6.4.2. Timed Cycle Control (RTC or ATC) *41*
6.4.3. Tolerance Settings *43*
6.5. ERROR MESSAGES 44
6.5.1. Error Message Display *44*
6.5.2. Clearing Error Codes *45*
6.6. RUN SCREENS 46
6.6.1. Meters Run Screen *47*
6.6.2. Totalizer Run Screen *47*
6.6.3. Cycle Run Screen *48*
6.6.4. Diagnostics Run Screen *48*
6.7. CURRENT AND VOLTAGE SETTINGS 49
6.7.1. Voltage Setting Adjustment *49*
6.7.2. Current Setting Adjustment *49*
6.8. SETTING ADJUSTMENT AND REGULATION MODES 50
6.8.1. Setting Adjustment (while viewing the setting) *50*
6.8.2. Setting Adjustment (while viewing the output value) *50*
6.8.3. Current Regulation *50*
6.8.4. Voltage Regulation *50*
6.8.5. Current Regulation with Voltage Limit (crossover) *51*
6.8.6. Voltage Regulation with Current Limit (crossover) *51*
6.9. CYCLE PAUSE/RESUME USING THE OPER/STBY SWITCH 51
7. REMOTE HOST CONTROL 53
7.1. OVERVIEW 53
7.2. HOST PORT COMMUNICATIONS SETTINGS 53
7.3. HOST PORT CONNECTIONS 53
7.4. HOST PORT PROTOCOL 53
8. REMOTE OPERATE/STANDBY CONTROL 54
9. REMOTE ANALOG CONTROL (OPTION) 55
9.1. REMOTE ANALOG READ BACK 55
9.1.1. Analog Output Scaling *55*
9.2. REMOTE ANALOG SETTING CONTROL 56
9.2.1. Analog Input Scaling *56*
9.3. REMOTE OPERATE/STANDBY FOR ANALOG CONTROL 56

10. CALIBRATION PROCEDURE 57
10.1. OVERVIEW 57
10.1.1. Equipment 57
10.1.2. Calibration Summary 59
10.1.3. Restoring the default calibration values 61
10.2. CALIBRATION STEPS 62
10.2.1. Current Output and Read Back Calibration 62
10.2.2. Voltage Output and Read Back Calibration 64
10.2.3. Analog Calibration (Optional) 66
11. OPTIONAL FEATURES AND CONTROLS 70
11.1. ANALOG CONTROL CARD 70
12. MAINTENANCE 70
12.1. CLEANING 70
12.2. FILTER REPLACEMENT (IF EQUIPPED) 70
12.3. COOLING FAN REPLACEMENT 70
APPENDIX A: MENU TREE 72
A.1 MENU TREE FORMAT 73
A.2 POWER ON/OFF SEQUENCES 74
A.2.1 Power On in Standby 74
A.2.2 Power On Resume Cycle 75
A.3 CYCLE PAUSE/RESUME 76
A.4 DISPLAY SELECT MENU 77
A.5 UNIT SETUP MENU 78
A.5.1 Cycle Setup Menu 79
A.5.2 Tolerance Setup Menu 80
A.5.3 Error Handling Setup Menu 81
A.6 UNIT CONFIGURATION MENU 82
A.6.1 Totalizer Configuration Menu 83
A.6.2 Host Port Configuration Menu 84
A.6.3 Remote Control Configuration Menu 85
A.6.4 System Configuration Menu 86
A.6.5 Calibrate Configuration Menu 93
APPENDIX B: HOST PORT PROTOCOL 98
B.1.1 Host Protocol Version Information 98
B.1.2 Command List 98
B.1.3 Command Format 99
B.1.4 Formatting Rules 99
B.1.5 Unit Addressing (@AA.a) 100
B.1.6 Communications Settings (factory default) – RS485 101
B.1.7 CRC Calculation 102

B.1.8 ACK Response Command *103*
B.1.9 NAK Response Command *104*
B.1.10 CRC Disable/Enable Command "c" *106*
B.1.11 Delimiter Text Disable/Enable Command "i" *107*
B.1.12 Setup Command "s": *108*
B.1.13 State Command "a": *110*
B.1.14 Readings Command "d": *112*
B.1.15 Error Status Command "m": *114*
B.1.16 Error History Command "h": *115*
B.1.17 User Settings Command "t": *116*
B.1.18 Unit Info Command "u": *119*
APPENDIX C: ERROR CODES **121**
REVISION HISTORY **126**

1. Introduction

1.1. TWO YEAR NEW PRODUCT WARRANTY

DYNATRONIX, INC., hereby warrants to the purchaser that all new products sold are guaranteed against defects in materials or manufacture for **two years** after shipment. DYNATRONIX, INC., expressly reserves the right to offer an extended warranty at its sole discretion. Such express warranty shall not be deemed effective unless expressly authorized by DYNATRONIX, INC., personnel. DYNATRONIX, INC., at its sole discretion, will repair or replace any defective products that are returned in accordance within the time period proscribed by this warranty.

All products for repair or examination must be returned to DYNATRONIX, INC., prepaid. The defective product, as repaired or replaced, requires the issuance of a Return Material Authorization Number ("RMA") from DYNATRONIX, INC., personnel prior to acceptance for repair or replacement by DYNATRONIX, INC. An RMA will be issued upon determination by DYNATRONIX, INC., personnel that the defective product requires factory repair. The customer assumes all shipment expenses of the returned product to and from DYNATRONIX, INC., within the warranty period.

DYNATRONIX, INC.'s liability, under this warranty, shall in any event not exceed the original purchase price of the product. To make a claim under this warranty, it is the responsibility of the purchaser to immediately contact DYNATRONIX, INC., and provide proof of the product's model, part number, input and output voltage and serial number. DYNATRONIX, Inc., will then determine whether the product remains under warranty.

This warranty **DOES NOT COVER** failures caused by any of the following:

1. Misuse, negligence or accident;
2. Alterations made by individuals or parties not directly employed by DYNATRONIX, INC.

This warranty **DOES NOT EXTEND** to commercial sub-assemblies that are guaranteed by a manufacturer's warranty.

This warranty becomes effective upon the date the product is shipped. In the event that a product no longer covered by the NEW PRODUCT WARRANTY is sent for repair, the provisions of the REPAIR WARRANTY as detailed below govern.

DYNATRONIX, INC., EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING, WITHOUT LIMITATION, ALL EXPRESS WARRANTIES, THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND THE IMPLIED WARRANTY OF MERCHANTABILITY. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

REPAIR WARRANTY

DYNATRONIX, INC., hereby warrants to the purchaser that products previously purchased as new from DYNATRONIX, INC., and returned to DYNATRONIX, INC., for repair or replacement be hereby governed by the provisions of the REPAIR WARRANTY. DYNATRONIX, INC., expressly reserves the right to extend the REPAIR WARRANTY to products not purchased from DYNATRONIX, INC., at its sole discretion. The REPAIR WARRANTY shall exclude all products not purchased from DYNATRONIX, INC., unless expressly authorized by DYNATRONIX, INC., personnel.

DYNATRONIX, INC., guarantees that all repairs be free from defects for ninety (90) days after return shipment to purchaser. Product failures not related to repairs done by DYNATRONIX, INC., shall not be covered by the REPAIR WARRANTY. DYNATRONIX, INC., further warrants that repair investigations that fail to identify product defects shall be guaranteed for a ninety (90) day period after return shipment to customer. In the event that the product fails within the stated ninety (90) day period after the inspection, DYNATRONIX, INC., agrees to assume the in-out freight costs for subsequent returns of the product, experiencing the complained of problem, for an additional ninety (90) day period.

Effective Date: January 1, 2006

1.2. Contact Information

Contact Information

Corporate Headquarters

Dynatronix, Inc
462 Griffin Boulevard
Amery, WI 54001 USA

Telephone: (715) 268-8118
FAX: (715) 268-8183
Toll-Free USA: (800) 826-7172
www.dynatronix.com

Customer Support
Dynatronix, Inc.
462 Griffin Boulevard
Amery, WI 54001 USA

Phone (715) 268- 8118
Fax (715) 268-8183
Toll-Free USA: (800) 826-7172
techsupport@dynatronix.com
www.dynatronix.com

2. Safety Precautions

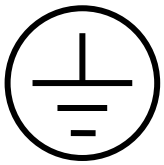
Before proceeding any further through this manual, this section should be read thoroughly to protect yourself and your equipment.

C A U T I O N

TO REDUCE THE RISK OF ELECTRIC SHOCK, UNIT MUST BE CONNECTED TO EARTH GROUND.
REMOVE POWER BEFORE OPENING PANELS.

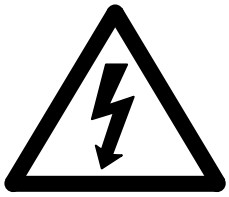
1. To properly operate this power supply, only electric cords with a 3-prong grounded system are to be used.
2. The electric cord providing power to the machine should be plugged in only to a grounded outlet that complies with U.L. and/or OSHA safety requirements, or local regulations.
3. If necessary to work inside the cabinet, remember to remove AC power before opening any panels. Not doing so may endanger yourself and your equipment. The means of disconnecting the power supply is either the removal of the detachable power supply cord from the power inlet or power receptacle or both. If the power cord is direct connected to the AC source as well as the power supply, turn off the local safety or power panel branch breaker which provides AC to the power supply. Follow your lock out / tag out procedures to ensure that power is not unexpectedly applied while servicing.
4. This unit contains no user serviceable parts. All repairs or modifications to this unit must be done at the Dynatronix factory, or at an authorized Dynatronix Service Center, or by a qualified service technician. See the Table of Contents section for a list of authorized service centers in the USA and Europe.
5. If necessary to work inside of cabinet with power on DO NOT wear metal objects on hands or wrists because of the various DC and AC voltages present.
6. If the equipment is used in a manner other than mentioned in this manual, the protection provided by this equipment may be impaired.

7. This symbol indicates a protective earth connection.



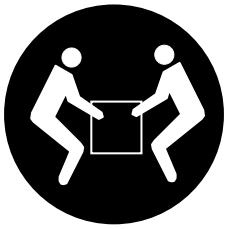
8. This symbol means to consult the product manual for additional information.

9. This label indicates where high AC or DC voltages are located inside of the unit. Be aware of these locations if power is needed for any work being done inside of unit. Not doing so may endanger yourself and your equipment.



10. This label indicates where components or surfaces are operating at temperatures which might cause injury either directly (burn) or indirectly (involuntarily moving body into another danger). This label is used most often on the output transistor heatsinks.

11. If this power supply weighs more than 40lb / 18kg (see Section 4 - Specifications), it must be lifted by two persons. Always use proper lifting technique.



12. Use of this product for purposes other than those specified in this manual is not recommended. Use for other purposes may give unexpected results or cause damage to the power supply and/or the system it is being used in.

3. Functional Overview

The LT1200X series plating power supply is a compact, high power unit that offers a wide range of features for the plating industry. It has universal power input with power factor correction. The power supply has a sealed design with a fan cooled heat sink tunnel. The unit is packaged in a 316 stainless steel ½ rack sized enclosure.

The LT comes with a Smart user interface. The user can set and monitor the voltage and current and there are indicators for errors and status of the unit. The settings are changed using multi-turn encoders. The encoders have pushbutton switches for changing the meter display from the readings to the settings for visual adjustment of the set point. By using the proper settings the power supply can be set to run in current, voltage or crossover regulation modes.

The LT Smart user interface contains menus that allow various features to be configured and provide for display of information regarding cycle status.

The LT supports the following features

- Manual Cycle Control
- Real Time Cycle Control (RTC)
- Amp Time Cycle Control (ATC)
- User Configurable Totalizer
- Over Temperature Warning (before shut down)
- Over Temperature Shut down
- Fan speed based on internal temperature
- Configurable Power Up Mode (always in standby, or in last mode)
- Remote operate/standby control (isolated digital input)
- Host port (RS485)
- Optional analog control (4-20mA, 05V, 0-10V)
- Digital Calibration
- Alarms and diagnostics

- Tolerance
- Power failure
- Over temperature warning
- Over temperature shut down
- Fan diagnostics
- Various System diagnostics

4. Product Specifications

<table>
<tr><th colspan="4">PRODUCT SPECIFICATIONS</th></tr>
<tr><td>INPUT POWER</td><td colspan="3">Universal input, 100-240VAC, 50-60Hz, single phase.
**LT12-100 input: 200-240VAC, 50-60Hz, single phase.</td></tr>
<tr><td>INPUT PROTECTION</td><td colspan="3">Main: The input is protected by two internal fuses (Labeled F1 & F2) located on printed circuit board assembly 138-0512-00.</td></tr>
<tr><td></td><td>MODEL</td><td>MAXIMUM INPUT CURRENT AT 115VAC INPUT</td><td>FUSE RATING</td></tr>
<tr><td></td><td>LT6-5</td><td>0.4A</td><td>MDA1 – 1Amp, 250VAC</td></tr>
<tr><td></td><td>LT6-10</td><td>1A</td><td>MDA2 – 2Amp, 250VAC</td></tr>
<tr><td></td><td>LT6-25</td><td>2A</td><td>MDA3 – 3Amp, 250VAC</td></tr>
<tr><td></td><td>LT6-50</td><td>4A</td><td>MDA5 – 5Amp, 250VAC</td></tr>
<tr><td></td><td>LT6-75</td><td>5.5A</td><td>MDA8 – 8Amp, 250VAC</td></tr>
<tr><td></td><td>LT6-100</td><td>7.5A</td><td>MDA10 - 10Amp, 250VAC</td></tr>
<tr><td></td><td>LT9-10</td><td>1.5A</td><td>MDA2 - 2Amp, 250VAC</td></tr>
<tr><td></td><td>LT9-25</td><td>3A</td><td>MDA5 - 5Amp, 250VAC</td></tr>
<tr><td></td><td>LT9-50</td><td>5.5A</td><td>MDA8 - 8Amp, 250VAC</td></tr>
<tr><td></td><td>LT9-75</td><td>7.5A</td><td>MDA10 - 10Amp, 250VAC</td></tr>
<tr><td></td><td>LT9-100</td><td>11A</td><td>MDA15 - 15Amp, 250VAC</td></tr>
<tr><td></td><td>LT12-10</td><td>1.5A</td><td>MDA2 – 2Amp, 250VAC</td></tr>
<tr><td></td><td>LT12-25</td><td>3.5A</td><td>MDA5 – 5Amp, 250VAC</td></tr>
<tr><td></td><td>LT12-50</td><td>7A</td><td>MDA10 - 10Amp, 250VAC</td></tr>
<tr><td></td><td>LT12-75</td><td>11A</td><td>MDA15 - 15Amp, 250VAC</td></tr>
<tr><td></td><td>**LT12-100</td><td>7.5A
** AT 200VAC INPUT</td><td>MDA10 - 10Amp, 250VAC</td></tr>
<tr><td></td><td>LT18-10</td><td>2.5A</td><td>MDA3 – 3Amp, 250VAC</td></tr>
<tr><td></td><td>LT18-25</td><td>5.5A</td><td>MDA8 – 8Amp, 250VAC</td></tr>
<tr><td></td><td>LT18-50</td><td>11A</td><td>MDA15 - 15Amp, 250VAC</td></tr>
<tr><td></td><td>LT18-60</td><td>12A</td><td>MDA15 - 15Amp, 250VAC</td></tr>
<tr><td></td><td>LT24-10</td><td>3A</td><td>MDA4 – 5Amp, 250VAC</td></tr>
<tr><td></td><td>LT24-25</td><td>7A</td><td>MDA10 - 10Amp, 250VAC</td></tr>
<tr><td></td><td>LT24-50</td><td>14.5A</td><td>MDA15 - 20Amp, 250VAC</td></tr>
<tr><td></td><td>LT48-10</td><td>6A</td><td>MDA8 – 8Amp, 250VAC</td></tr>
<tr><td></td><td>LT48-25</td><td>14.5A</td><td>MDA20 - 20Amp, 250VAC</td></tr>
</table>

OUTPUT RATING	MODEL	OUTPUT RATING
	LT6-5	0-6V, 0-5A, 30W
	LT6-10	0-6V, 0-10A, 60W
	LT6-25	0-6V, 0-25A, 150W
	LT6-50	0-6V, 0-50A, 300W
	LT6-75	0-6V, 0-75A, 450W
	LT6-100	0-6V, 0-100A, 600W
	LT9-10	0-9V, 0-10A, 90W
	LT9-25	0-9V, 0-25A, 225W
	LT9-50	0-9V, 0-50A, 450W
	LT9-75	0-9V, 0-75A, 675W
	LT9-100	0-9V, 0-100A, 900W
	LT12-10	0-12V, 0-10A, 120W
	LT12-25	0-12V, 0-25A, 300W
	LT12-50	0-12V, 0-50A, 600W
	LT12-75	0-12V, 0-75A, 900W
	LT12-100	0-12V, 0-100A, 1200W
	LT18-10	0-18V, 0-10A, 180W
	LT18-25	0-18V, 0-25A, 450W
	LT18-50	0-18V, 0-50A, 900W
	LT18-60	0-18V, 0-60A, 1080W
	LT24-10	0-24V, 0-10A, 240W
	LT24-25	0-24V, 0-25A, 600W
	LT24-50	0-24V, 0-50A, 1200W
	LT48-10	0-48V, 0-10A, 480W
	LT48-25	0-48V, 0-25A, 1200W

OUTPUT PROTECTION	The internal controller will not accept commands that will exceed the output rating of the power supply.
CONTROLS	Smart LT Front panel (display, encoders, switches). Host Port (RS485) Optional Analog Interface.
ENVIRONMENTAL CONDITIONS	INDOOR USE ONLY Operating temperature: 0 - 40C Non-condensing humidity conditions 15-90% RH Storage temperature: -20 - 85C
LOAD REGULATION	Current: : ±0.5% of maximum current rating for the power supply from 10% -100% load Voltage: : ±0.5% of maximum voltage rating for the power supply from 10% - 100% load
LINE REGULATION	For line conditions as listed in 4.1 Current: : ±0.5% of maximum current rating for the power supply Voltage: : ±0.5% of maximum voltage rating for the power supply
RIPPLE	120mVrms maximum throughout operating range
COOLING	Variable fan speed forced air cooling: in through front, out through rear. Allow 2 inches (51mm) minimum clearance on front and rear of unit.
ENCLOSURE	Half-rack enclosure, 316 Stainless Steel
SIZE	3.43” (87.1mm)H x 8.45” (214.6mm)W x 16” (406mm)D (18” (457mm)D including controls and connectors)
WEIGHT	Approximately 17lbs (7.7kg).

5. Installation Instructions

5.1. Power Input

5.1.1. Input Power Requirements

The input power and output capacity of each rectifier is specified on the equipment serial tag located on the back of the unit. The power supply has a universal input, 100-240VAC, 50-60Hz, single phase. Derate maximum output power to 1000W for input voltages less than 100Vac.

5.1.2. Input Power Connection

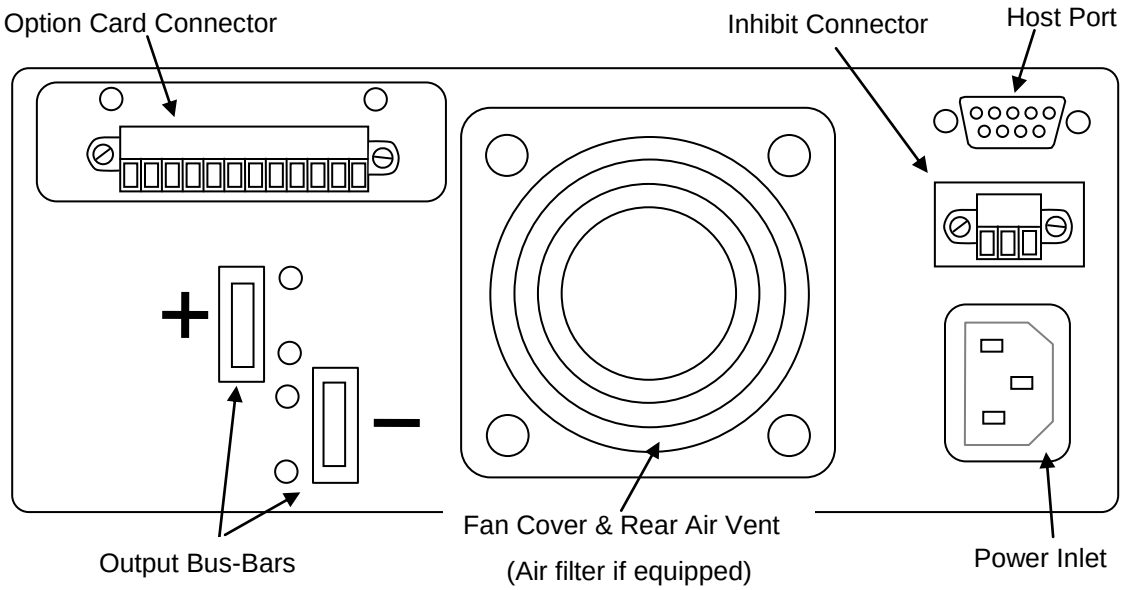
Make sure the Main Power Switch is in the OFF (0) position. Plug the female end of the power cord into the back of the power supply. Connect the male end of the power cord* to the correct supply in accordance with U.L. and/or OSHA specifications.

*****If power supply does not come equipped with a male plug, use Interpower NEMA 6-20 (250Vac, 20A) P/N: 88030180 or equivalent.

5.2. Mounting

Place the LT1200X Series power supply on a shelf capable of accepting a 1/2 rack mount package.

Cooling is front to rear unless power supply is equipped with a rear filter cooling is from back to front. Do not block airflow to the unit. Leave at least 2 inches (5cm) in front of and behind the power supply for adequate ventilation. Place the unit in an area which has adequate ventilation to prevent condensation. Do not spray liquids on or inside power supply. Keeping units away from



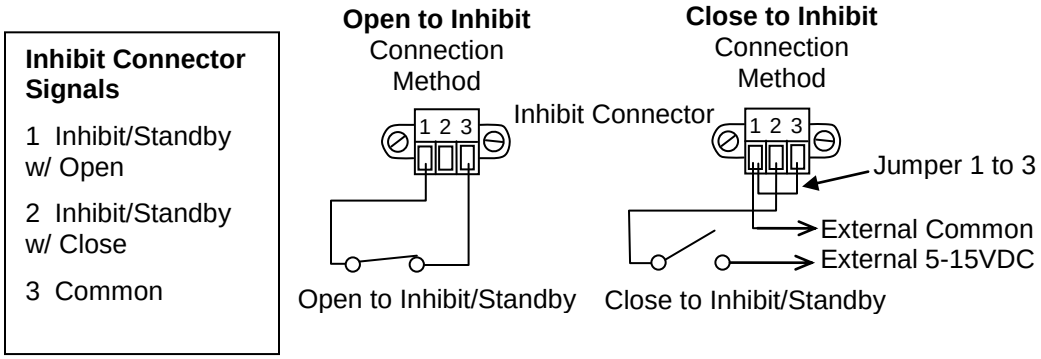
corrosive plumes will help prolong the life of your capital investment.

5.3. Output Power Connections

Located at the rear of the LT1200X Series are two output bus-bar connectors which are used to connect to the bath. Make sure the connections to the bus-bars are tight to reduce heating. Loose connections to the bus-bars will damage the power supply.

5.4. Inhibit Signal Connection

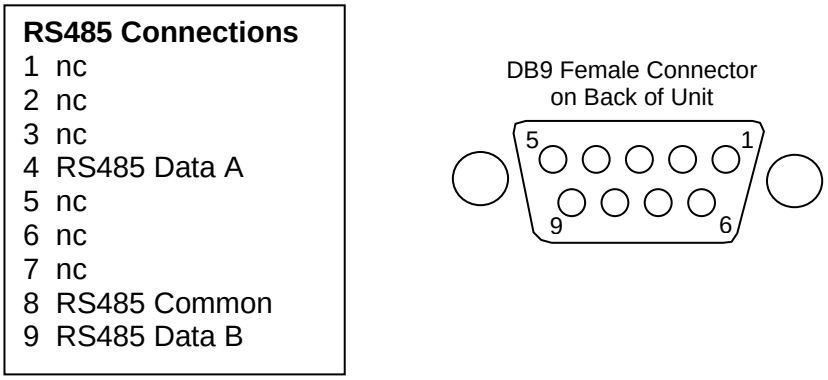
When the inhibit input is active the power supply output is disabled and the front panel “inhibit” LED illuminates. The inhibit signal can be used for a safety interlock or as a remote operate/standby control. The inhibit signal can be a switch closure or a voltage signal input depending on how the inhibit terminals are wired (see the diagram below). If the inhibit signal is not used pins 1 and 3 must be connected with a jumper wire to enable power supply operation. For details on how to use the inhibit input for remote operate/standby control see 6.3.6.Remote Operate/Standby Control (Digital Input) and 8.0.Remote Operate/Standby Control.



Inhibit Signal Connection Diagram

5.5. Serial Host Port Connections

The serial host port can be used to monitor and/or control the LT power supply using the ASCII Host Protocol (See 7.0.Remote Host Control). The serial host port supports a half duplex RS485 interface. Multiple LT power supplies can be connected to a single RS485 bus (multi-drop). Each device on the RS485 bus is individually addressed using the ASCII Host Protocol. If an RS232 device (such as a PC) will be connected to the LT host port then an RS232 to RS485 converter module will be required (not included).



5.6. Analog Card Connections (Optional 138-0471-XX Card)

Rectifiers which have optional analog control will be equipped with the **138-0471-xx** card and require customer supplied wiring. See wiring diagram figures below for connection information. The following give a description of the control and readback signals on the 12 pin terminal strip.

VOLTAGE CONTROL (VC)
Control of the power supply output voltage can be achieved by connecting the appropriate signal to pins 6 (+) and 5 (-).

CURRENT CONTROL (CC)
Control of the power supply output current can be achieved by connecting the appropriate signal to pins 8 (+) and 7 (-).

VOLTAGE READBACK (VRB)
Monitoring of the power supply output voltage can be achieved by connecting the appropriate sensing circuitry to pins 9 (+) and 10 (-).

CURRENT READBACK (CRB)
Monitoring of the power supply output current can be achieved by connecting the appropriate sensing circuitry to pins 11 (+) and 12 (-).

Pin 3 can be used for a DC COMMON connection.

Pin 1 can be used as a connection point for the cabling shields.

NOTE: To reduce the possibility of electrical noise interfering with the proper operation of the control system, use shielded twisted pair for all wiring between the analog controller and the power supply. Belden™ 8761 or equivalent cable type is recommended.

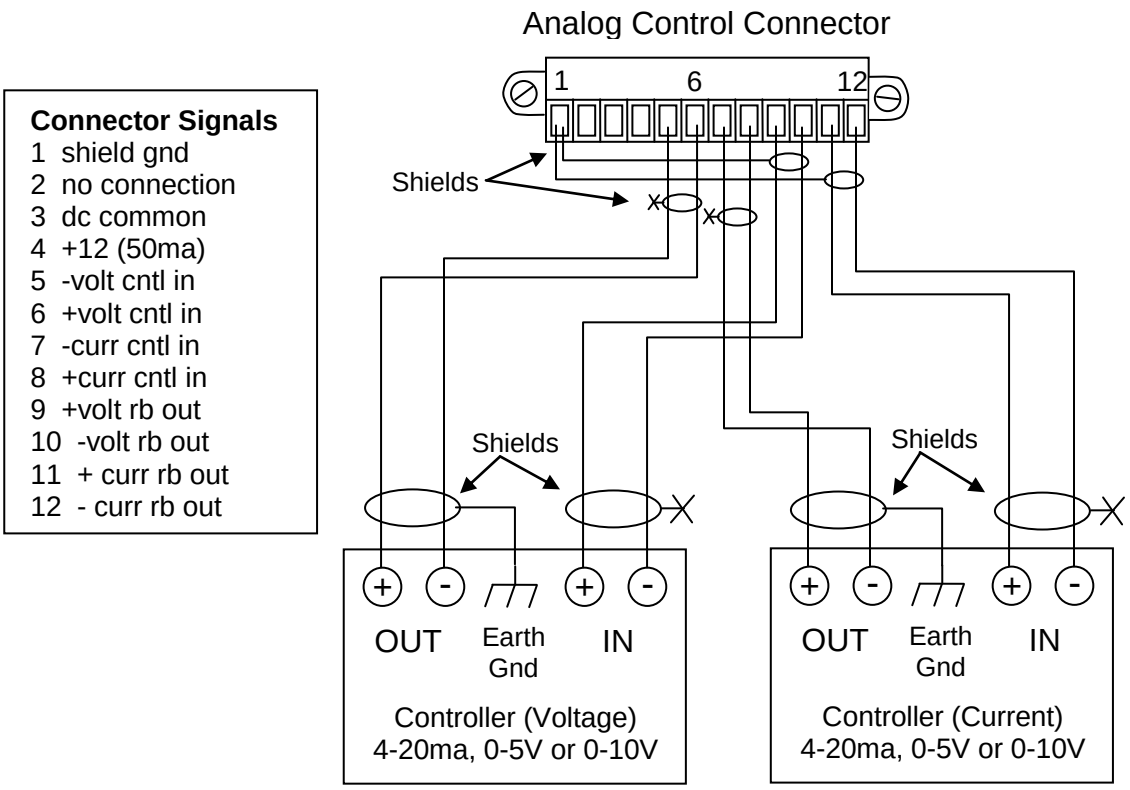
NOTE: The DC COM (pin 3) is used to connect the power supply's DC common to the controller's DC common. The shielding for the voltage & current control lines should be earth grounded at the controller and should be cut-off at the power supply. The shielding for the voltage & current readback lines should be earth grounded at the power supply (pin 1 - SHIELD) and cut-off at the controller. See diagrams below.

NOTE: When using 4-20mA control, the controller's input channels must be isolated from each other. It is recommended that isolated receivers (ex. OPTO 22 AD3T or equivalent) be used with the curr rd out and volt rb out transmitter channels. These transmitter channels are self powered.

The receiver inputs and transmitter outputs are ground isolated from the power supply's DC common and are isolated from earth ground as well. However, be aware that both input channels and both output channels of the AI board, do share a common signal ground. In other words, there is no isolation from channel to channel or receiver inputs to transmitter outputs except that provided by the differential inputs. A common ground signal from the Remote controller is required.

NOTE: MAXIMUM LOOP RESISTANCE THAT CAN BE IN SERIES BETWEEN THE (+) AND (-) OF THE CURRENT OR VOLTAGE READBACK IS 400 OHMS

Units with **Current and Voltage Control and Readback** should be wired as shown below:



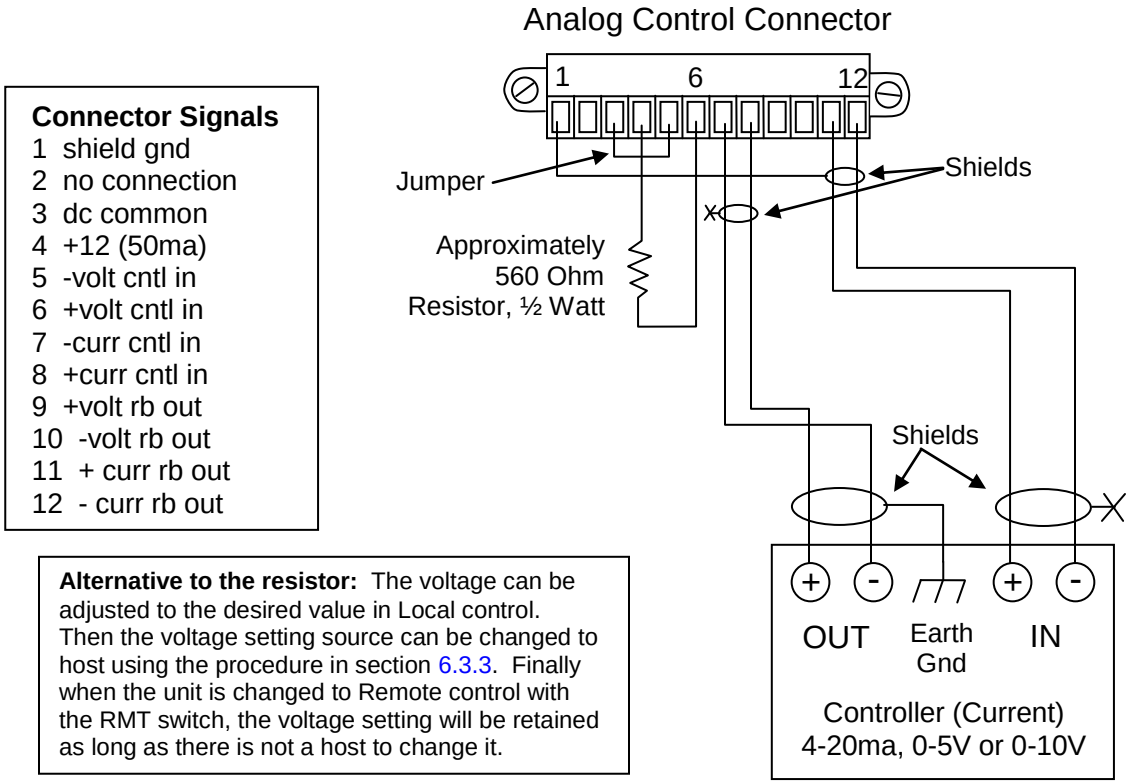
Typical Analog Control Wiring (Current and Voltage Control)

NOTE: The analog control card has control of the output current and voltage if it is enabled by pressing the RMT/LCL button so that the RMT indicator comes on.

NOTE: The unit must be in operate, OPER indicator on, for the remote analog control inputs to control the power supply output.

NOTE: If the analog control card is not controlling the output when in Remote mode, use the procedure in section 6.3.3.Remote Control Configuration to verify that the source of the voltage and current settings while in remote control mode are set to the options card.

Units using **only Current Control and Readback** should be wired as shown below. The voltage level is set to maximum using a resistor.

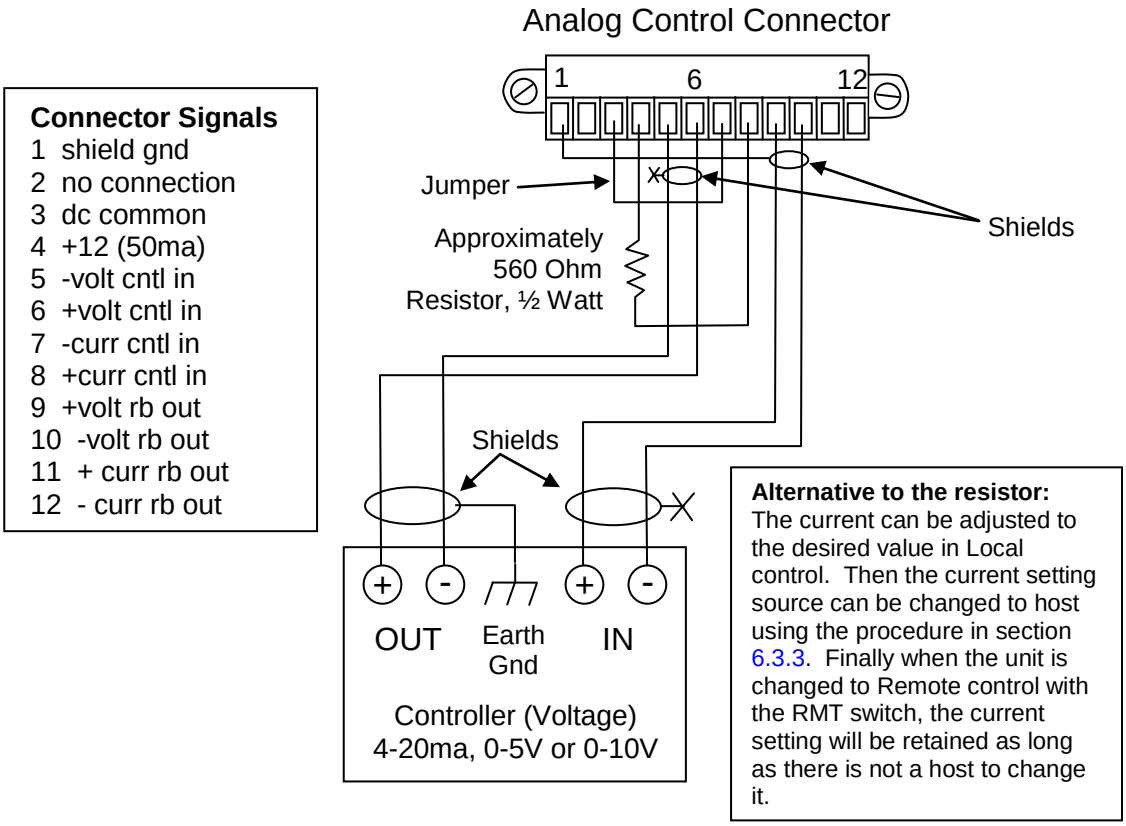


Connector Signals
1 shield gnd
2 no connection
3 dc common
4 +12 (50ma)
5 -volt cntl in
6 +volt cntl in
7 -curr cntl in
8 +curr cntl in
9 +volt rb out
10 -volt rb out
11 + curr rb out
12 - curr rb out

Alternative to the resistor: The voltage can be adjusted to the desired value in Local control. Then the voltage setting source can be changed to host using the procedure in section 6.3.3. Finally when the unit is changed to Remote control with the RMT switch, the voltage setting will be retained as long as there is not a host to change it.

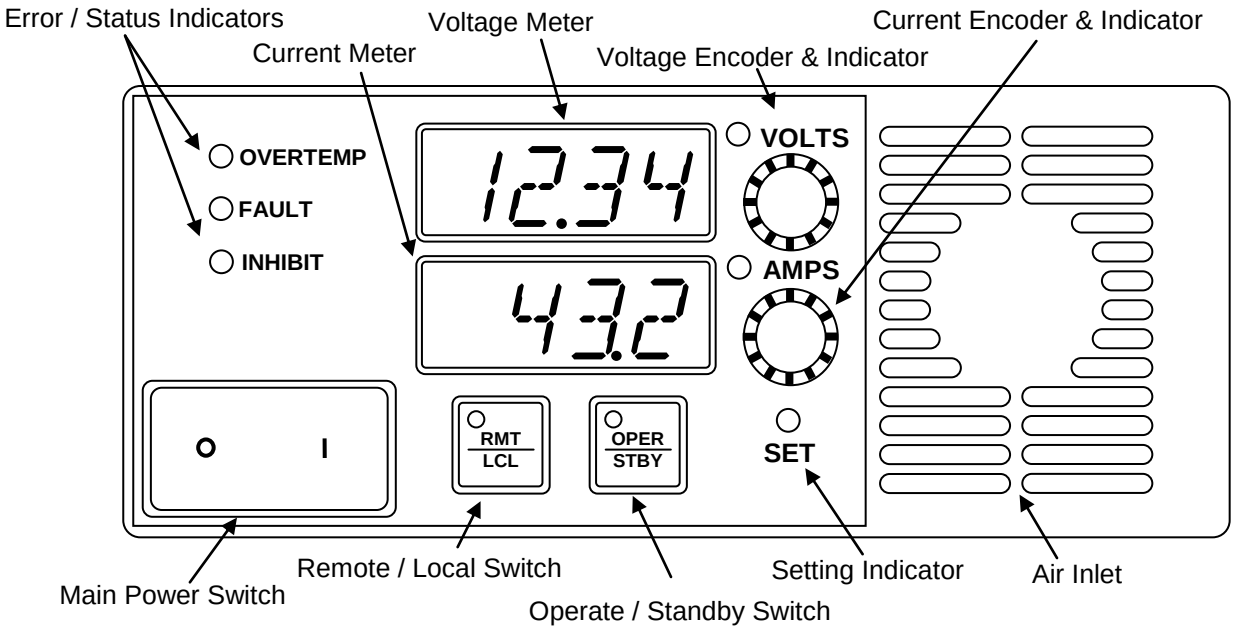
Typical Analog Control Wiring (Current Control Only)

Units using **Only Voltage Control and Readback** should be wired as shown below. The current level is set to maximum using a resistor.


Analog Control Connector
Connector Signals
1 shield gnd
2 no connection
3 dc common
4 +12 (50ma)
5 -volt cntl in
6 +volt cntl in
7 -curr cntl in
8 +curr cntl in
9 +volt rb out
10 -volt rb out
11 + curr rb out
12 - curr rb out
1
6
12
Jumper
Shields
Approximately
560 Ohm
Resistor, ½ Watt
Shields
+
-
+
-
OUT
Earth
Gnd
IN
Controller (Voltage)
4-20ma, 0-5V or 0-10V
Alternative to the resistor:
The current can be adjusted to the desired value in Local control. Then the current setting source can be changed to host using the procedure in section 6.3.3. Finally when the unit is changed to Remote control with the RMT switch, the current setting will be retained as long as there is not a host to change it.

Typical Analog Control Wiring (Voltage Control Only)

6. Operating Procedures



6.1. Front Panel Controls

6.1.1. Displays

In addition to providing current and voltage meters the displays can display other supply information. The displays can show numeric parameter values or text messages.

6.1.1.1. Run Screens

Run screens are shown during normal supply operation. An example of a run screen is the meters run screen which displays the output current and output voltage and allows for display and edit of the current and voltage settings. Other examples of run screens include totalizer time, cycle time, and diagnostics. The 'SET' lamp is off when a run screen is displayed.

6.1.1.2. Menus

Menus can be displayed to configure the power supply. The unit configuration menu contains items that are generally only set when a power supply is initially installed. The setup menu contains general cycle configuration such as selecting RTC or ATC control and setting current or voltage tolerances. The display select menu provides a method to select which run screen is displayed. The 'SET lamp is on steady when a menu is displayed. The 'SET' lamp blinks on and off when a parameter is displayed.

6.1.2. Encoder Functionality

The encoders can be turned clockwise or counter-clockwise. Each encoder also functions as a momentary switch when it is pushed in.

6.1.2.1. Encoder Usage in Run Screens

Pushing the encoder switch will display the setting (if available) for the associated display. For example, when the current and voltage meters run screen is displayed pressing the voltage encoder switch will display the voltage setting. Likewise pressing the current encoder switch will display the current setting. The 'SET' lamp blinks on and off when a setting is displayed.

When a setting is displayed each digit of the setting value can be individually adjusted. The setting digit that is being adjusted will flash on and off. Each press of the encoder switch selects the next digit. Rotating the encoder changes the selected digit value.

The setting display will return to the normal run screen display after the setting has not been adjusted for a short time. For example, if the voltage setting were displayed from the meters run screen the display would return to the output voltage meter after the setting had not been changed for a short time.

6.1.2.2. Encoder Usage in Menus

The encoders are used to access and navigate menus. Menus are accessed by simultaneously pressing and holding both encoders for some period of time (the amount of time depends on which menu is to be accessed). Once a menu is accessed the encoders can be used to navigate menus and change parameters.

Generally the voltage display shows the menu title and the current display shows a sub menu ('SET' lamp on) or parameter ('SET' lamp blinking on and off). Text that is blinking on and off indicates a selection that can be changed by rotating the associated encoder. Pressing the voltage encoder selects the displayed menu selection or parameter value. Numeric parameters within menus are edited the same way as the voltage and current settings are changed (one digit at a time).

6.1.3. Voltage Indicator

This indicator shows when the power supply is regulating the voltage level on the output. The current level will depend on the load resistance.

6.1.4. Current (Amps) Indicator

This indicator shows when the power supply is regulating the current level on the output. The voltage level will depend on the load resistance.

6.1.5. Operate / Standby Switch

This switch toggles between operate (OPER lamp on) and standby (OPER lamp off) modes. In operate mode the output of the supply is enabled and will output current depending on the settings. In standby mode the output of the supply is disabled.

Pressing the OPER/STBY switch while a timed cycle (ATC or RTC) is running will pause the currently running cycle (output disabled). The OPER/STBY lamp blinks on and off when a cycle is paused. Pressing the OPER/STBY switch while a cycle is paused will show the pause menu which allows the cycle to be stopped or resumed. The pause menu allows the user to use the current encoder to select between "End" (stop the cycle) or "Cont" (resume the cycle). With the desired action selected on the pause menu ("End" or "Cont") pressing the OPER/STBY switch takes the selected action. See 6.9.Cycle Pause/Resume using the OPER/STBY Switch for more information regarding the pause and resume functions.

The operate state can be restored after power is cycled, see 6.3.4.Power On Configuration for more information.

NOTE: The inhibit input and the host port can also change the operate state. See 8.0.Remote Operate/Standby Control and for details regarding these other methods of operate/standby control.

NOTE: The operate switch can be disabled to prevent changing the operate state from the front panel (see 6.3.7.Front Panel Button Lock Outs).

6.1.6. Remote / Local Switch

This switch toggles between local control (RMT lamp off) and remote control (RMT lamp on). In local control mode the LT front panel is used to control the supply. In remote control mode the power supply can be controlled by the analog control interface or by the host port (depending on the configuration of the supply, see 6.3.3.Remote Control Configuration). When the supply is in remote control mode host communications are indicated by flashing the remote lamp. The remote/local state is maintained through a power cycle.

NOTE: When the unit is in remote control mode (RMT lamp is illuminated) settings (current and voltage settings, cycle settings, and tolerance settings) cannot be adjusted from the front panel.

NOTE: The remote switch can be disabled to prevent changing the remote/local state from the front panel (see 6.3.7.Front Panel Button Lock Outs).

6.1.7. Inhibit Lamp

The inhibit lamp is ON when the inhibit input is active. The output of the power supply is disabled by a hardware interlock when the inhibit lamp is ON. The inhibit input can be used has a hardware disable of the output or for remote operate/standby control, see 8.0.Remote Operate/Standby Control for details.

6.1.8. Fault Lamp

When a fault is active the fault lamp is ON. When one or more faults are active the display will alternate between an error code and the normal display value. Error codes can also be read using the host port. Some faults will cause the output of the power supply to be disabled and will prevent operate mode.

Most error codes will self clear when the error condition clears. However certain error codes require manual clearing. An example of such an error code would be a power failure error code. The power failure error code is set if the unit lost power while the supply was in operate mode and the power failure alarm is enabled. When power returns the error code remains active until it is manually cleared.

See Appendix C: for a list of error codes. See 6.5.Error Messages for more details regarding the display and clearing of error codes.

6.1.9. Over Temperature Lamp

6.1.9.1. Over Temperature Warning

The over temperature lamp blinks on and off when the internal heat sink temperature reaches the warning level. The warning level indicates that the heat sink temperature is approaching unsafe levels that could damage the unit. A warning also indicates that if the temperature continues to increase the unit will be forced to standby mode until it cools down. The display will alternate between the normal display and the heat sink temperature. The output of the power supply is not affected by an over temperature warning.

6.1.9.2. Over Temperature Shut Down

The over temperature lamp is on steady if the heat sink temperature reaches a shut down level. When a shutdown level is reached the output of the supply is disabled (standby mode), and an error code is displayed, and the heat sink temperature is displayed. Operate mode will not be allowed until the unit cools down.

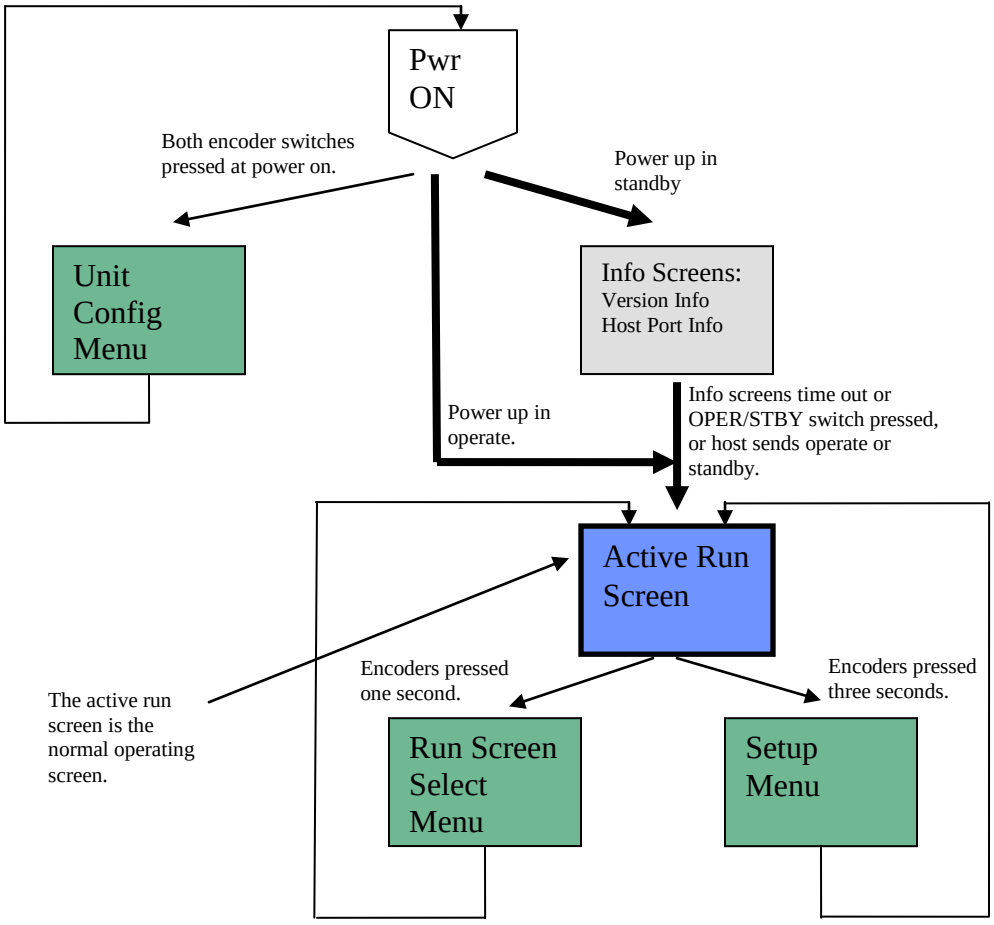
The power supply should not be turned off when it is in an over temperature condition. The power supply should be left on, in standby mode, so that the fan will run to cool down the power supply

6.2. Menu Overview

6.2.1. Menu Organization

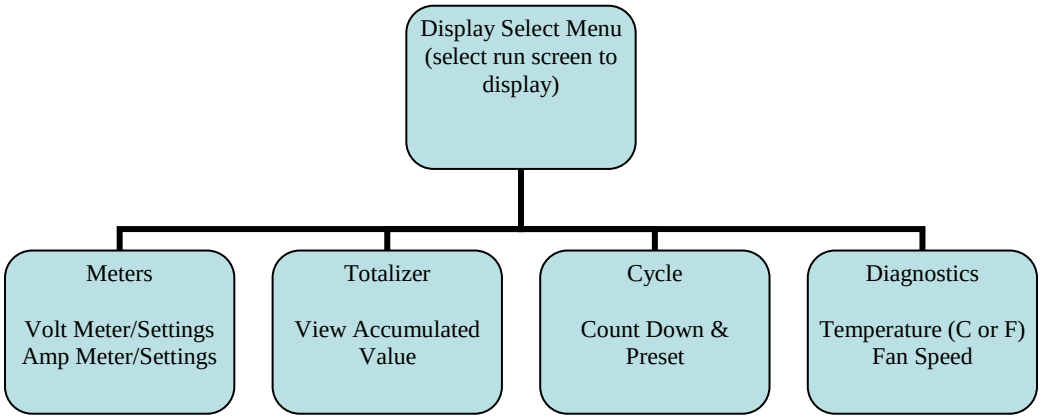
The LT display is organized into menus and run screens. Run screens provide information about the supply status, the supply output and other cycle status information. Several run screens are available providing various sets of information. Run screens are used during normal supply operation. Menus provide access to a list of parameters and configuration items related to power supply behavior and cycle control. The following diagram is an overview of the menus available and how they are accessed. The diagram shows that there are three menus (green) and that a normal power up will show the last active run screen (blue). The bold arrows show the path of a normal power on sequence. The run screen select menu and the setup menu can be accessed at any time from the active run screen. The unit configuration menu can only accessed at power on.

See Appendix A:Menu Tree for details on all the screens in each menu.


Pwr ON
Both encoder switches pressed at power on.
Power up in standby
Unit Config Menu
Info Screens:
Version Info
Host Port Info
Power up in operate.
Info screens time out or OPER/STBY switch pressed, or host sends operate or standby.
Active Run Screen
Encoders pressed one second.
Encoders pressed three seconds.
The active run screen is the normal operating screen.
Run Screen Select Menu
Setup Menu

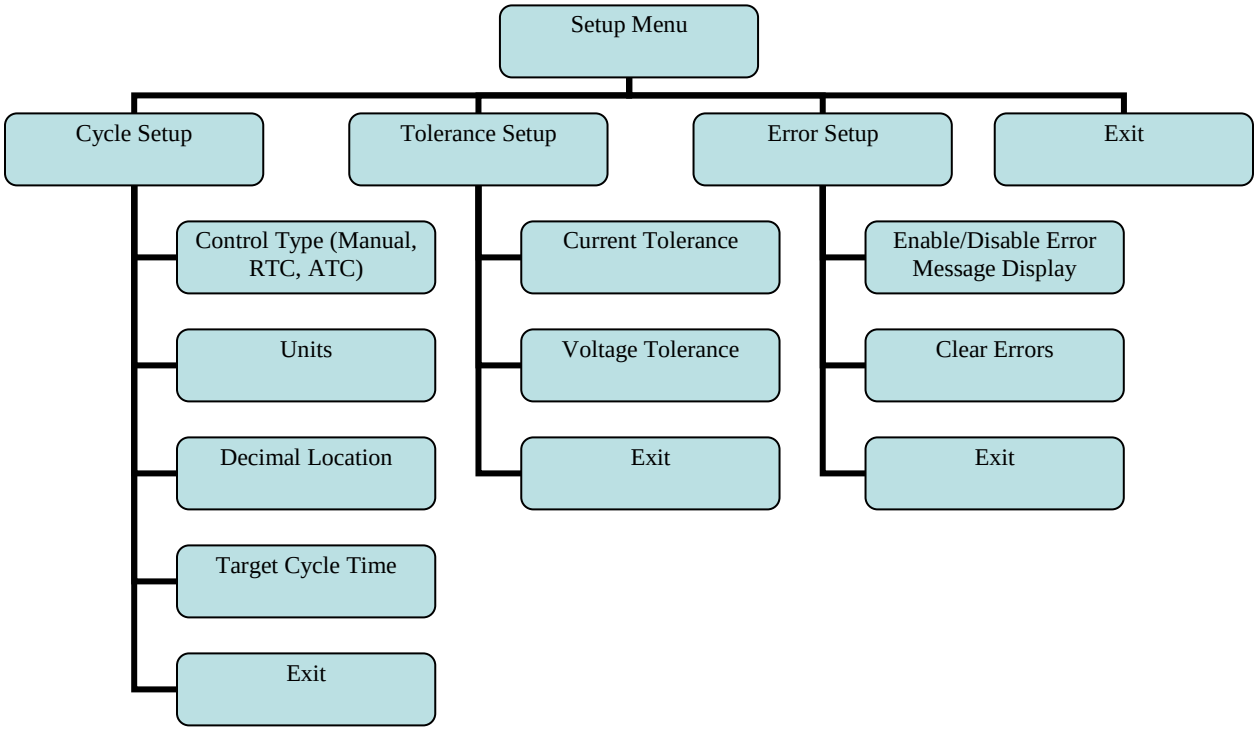
6.2.1.1. Display Select Menu

The display select menu allows the operator to select which “run screen” is displayed. The unit will power on showing the last run screen that was viewed.



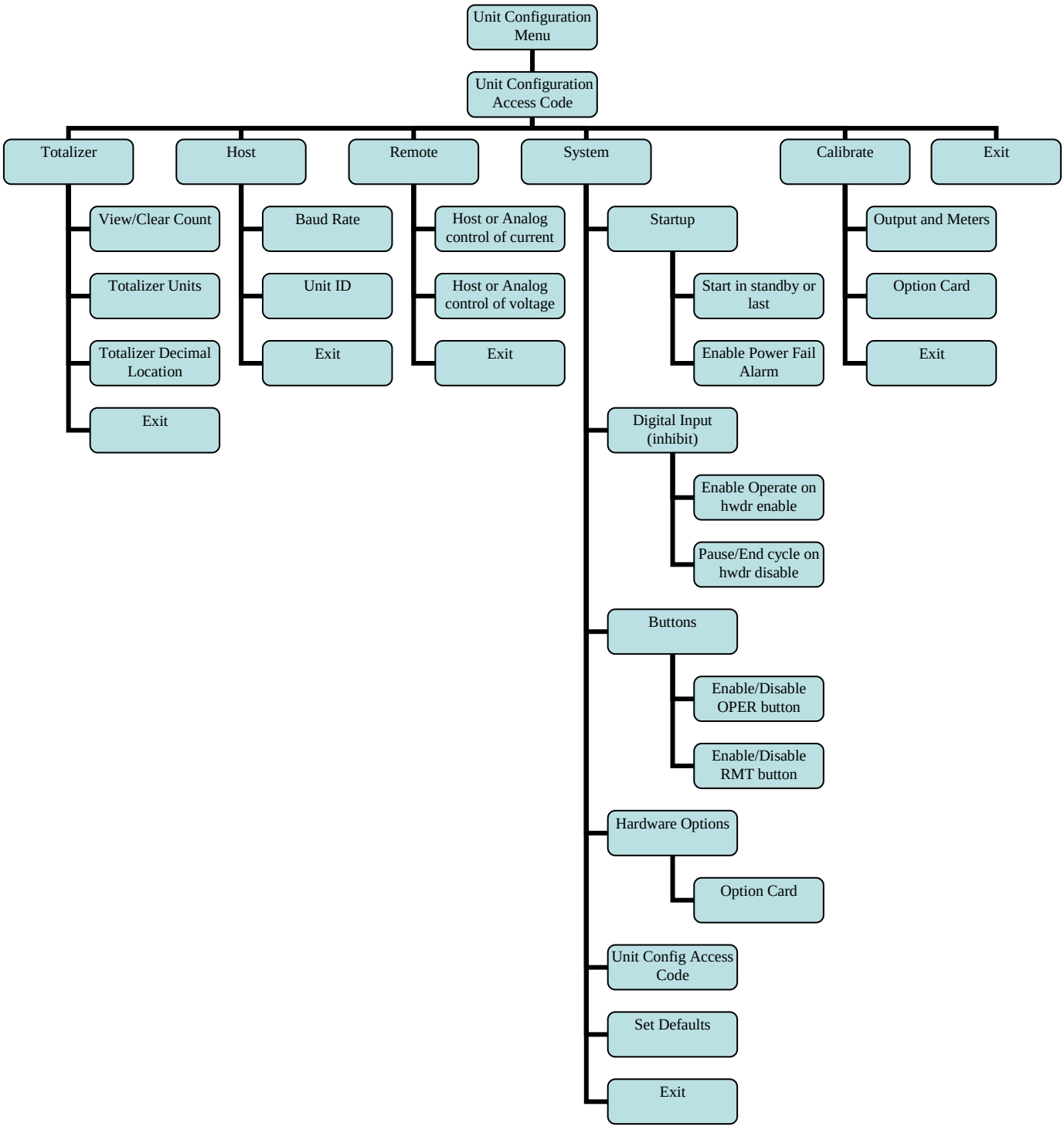
6.2.1.2. Setup Menu

The setup menu contains features and parameters that might be adjusted differently for each process.



6.2.1.3. Unit Configuration Menu

The unit configuration menu contains configuration parameters that will likely be changed infrequently, probably only one time when a unit is installed. This menu can only be accessed at power on and a password is required. An exit from this menu restarts the unit for normal operation (similar to a power cycle).



6.2.2. Menu Access

All menus are accessed by pressing and holding both encoder switches until the desired menu title is displayed. Menus that contain an “End” sub menu item are exited by selecting “End”. Menus with no “End” sub menu item are automatically exited after no changes are made for a period of time, or the voltage encoder switch is pressed to accept the selection.

The unit configuration menu is accessed by pressing and holding both encoder switches when the unit is powered on and releasing them after the display changes to “Unit” CFg”.

The display select menu is accessed from any run screen by pressing and holding both encoder switches until the display changes to “diSP” “SEL” (approximately one second).

The setup menu is accessed from any run screen by pressing and holding both encoder switches until the display changes to “Unit” “SEt” (approximately three seconds).

See Appendix A:Menu Tree for more details on menu access.

6.2.3. Menu Navigation

When a menu is displayed the SET lamp is illuminated (the SET lamp is off when a run screen is displayed). Menu titles are displayed on the top display. Sub menu names and parameters are displayed on the bottom display.

See Appendix A:Menu Tree for more details on menu navigation.

6.2.3.1. Entering and Exiting Sub Menus

Text that blinks on and off indicates a sub menu selection (SET lamp is on) or a parameter value that can be changed (SET lamp blinks on and off). Rotate the current encoder to select the desired sub menu. Press the voltage encoder switch to enter the selected sub menu.

To exit a menu or sub menu rotate the current encoder to select “End”, then press the voltage encoder switch to exit the sub menu. If there is no “End” selection available press the voltage encoder to accept the selection and exit the menu.

6.2.3.2. Changing Parameter Data

When parameter data is displayed the SET lamp blinks on and off. Parameter data can be text (like “on” or “OFF”) or it can be numeric. If the parameter data displayed can be changed it will blink on and off. In the case of numeric data only one digit will blink at a time and only one digit can be changed at a time.

To change a text parameter rotate the current encoder to select the desired text value. Press the voltage encoder switch to accept the value and return to the previous menu.

To change a numeric value rotate the current encoder to change the selected digit. Press the current encoder switch to select a different digit. When the desired numeric value is displayed press the voltage encoder switch to accept the value and return to the previous menu.

6.3. Unit Configuration

The “Unit Configuration Menu” is used to configure the power supply. Parameters in this menu will generally be configured when a unit is installed and will not need to be changed after that. Settings related to cycle control (current and voltage settings, RTC or ATC settings, etc) which may require changes related to the process that is running are located in the “Unit Setup Menu” (see 6.4.Cycle Control Settings for details regarding cycle control settings).

The “Unit Configuration Menu” can only be accessed when the power supply is first powered on. The “Unit Configuration Menu” is password protected. The default password is “0000”. The password can be changed from within the “Unit Configuration Menu”.

To enter the “Unit Configuration Menu” use the following procedure. See A.6.Unit Configuration Menu for more information regarding navigation of the “Unit Configuration Menu”.

1) With the power supply powered off press and hold both encoder switches.
2) While still holding both encoder switches turn the power on.
3) Continue holding both encoder switches until the display shows “Unit” “CFg”, then release the encoder switches.
4) The unit configuration password must be entered before access to the “Unit Configuration Menu” is granted. The display shows “Unit CFg COdE” on the top display and the default password “0000” on the bottom display. If the password has not been changed from the default then press the voltage encoder switch to enter the “Unit Configuration Menu”. If the password has been changed then the correct password must be entered. Rotate the current encoder to adjust the selected digit (blinking digit). Each press of the current encoder advances the selected digit. Once the correct code has been entered press the voltage encoder switch to enter the “Unit Configuration Menu”.
5) Once access to the “Unit Configuration Menu” has been granted the top display will show “CFg” and the bottom display will show the selected sub menu. Rotating the current encoder will change the sub menu selection. Pressing the voltage encoder will enter the selected sub menu.
6) To exit the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “End”, then press the voltage encoder to exit the “Unit Configuration Menu”. The power supply will restart into its normal mode of operation displaying the last selected run screen.

6.3.1. Totalizer Configuration

The power supply contains a user configurable totalizer that accumulates amp time while the power supply outputs current. The “Totalizer Configuration Menu” can be used to configure the totalizer units and resolution as well as clear the totalizer.

The “Totalizer Configuration Menu” is accessed from the “Unit Configuration Menu” (see 6.3.Unit Configuration). To enter the “Totalizer Configuration Menu” select the “tot” sub menu from the “Unit Configuration Menu” and press the voltage encoder. The “Totalizer Configuration Menu” will show “tot” on the top display and the selected sub menu on the bottom display. For more details regarding “Totalizer Configuration Menu” navigation see A.6.1.Totalizer Configuration Menu.

6.3.1.1. Clearing the Totalizer

The totalizer can be cleared from the “Totalizer Count Menu” located under the “Totalizer Configuration Menu”. Use the following procedure to clear the totalizer.

1) From the “Totalizer Configuration Menu” select the totalizer count sub menu. The “Totalizer Configuration Menu” displays “tot” on the top display and the selected sub menu on the bottom display. Rotate the current encoder until the display shows “tot” “cnt”, then press the voltage encoder to enter the “Totalizer Count Menu”.
2) The first screen in the “Totalizer Count Menu” shows the totalizer count value. Only half of the totalizer count is displayed at a time. This screen either shows the four most significant digits (“Hi”) or the four least significant digits (“Lo”). The top display indicates the totalizer units and which half of the totalizer count is displayed. Rotating the voltage encoder switches between display of the four most significant digits of the totalizer count and the four least significant digits of the totalizer count. See the table below for a detailed description of what the top display shows.
3) Press the voltage encoder switch to advance from the count display screen to the clear screen. The clear screen shows “CLr tot” on the top display. The bottom display shows the confirmation selection. Rotate the current encoder to change the confirmation selection from “no” to “yES” and then press the voltage encoder switch to clear the totalizer and return to the “Totalizer Configuration Menu”.
4) Rotate the current encoder until the display shows “tot” “End”, then press the voltage encoder switch to return to the “Unit Configuration Menu”.
5) If the totalizer was cleared, or any other changes were made in the “Totalizer Configuration Menu” you will be prompted to store the changes. Select “yES” to accept the changes or “no” cancel the changes. Note that selecting “no” will return the totalizer count back to its original value and it will not be cleared.

Totalizer Count Screen Messages:

Top Display Message	Totalizer Units	Totalizer Count Display
“tot AmP min Lo”	Amp Minutes	Four least significant digits
“tot Amp min Hi”	Amp Minutes	Four most significant digits
“tot Amp Hr Lo”	Amp Hours	Four least significant digits
“tot Amp Hr Hi”	Amp Hours	Four most significant digits

6.3.1.2. Totalizer Units and Resolution

The totalizer units and resolution can be set from the “Totalizer Configuration Menu”. Use the following procedure to set the totalizer units and resolution.

NOTE: Changing the totalizer units or resolution (decimal location) will not reset the totalizer count and it will not convert the previous count to a new count having the new units and resolution. Changes to the totalizer units or resolution could result in an un-expected totalizer count value. For clarity it is best to clear the totalizer count before changing the units or the resolution.

1) From the “Totalizer Configuration Menu” rotate the current encoder until the display shows “tot” “Unit”. Press the voltage encoder switch to enter the “Totalizer Units Menu”.
2) The “Totalizer Units Menu” displays “tot AmP” on the top display and the selected units on the bottom display. Rotate the current encoder to select the desired totalizer units. Select “Hr” for Amp Hours or select “min” for Amp Minutes. Press the voltage encoder switch to accept the selected units and return to the “Totalizer Configuration Menu”.
3) From the “Totalizer Configuration Menu” rotate the current encoder until the display shows “tot” “dEC”. Press the voltage encoder switch to enter the “Totalizer Decimal Menu”.
4) The “Totalizer Decimal Menu” shows “dEC” on the top display and the selected decimal point location on the bottom display. The decimal point location affects the resolution of the totalizer and the maximum value the totalizer can count to. The maximum totalizer count is 99999999, or 9999999.9, or 999999.99, or 99999.999, depending on the decimal point location. The totalizer count will roll over to zero and continue counting if the maximum count is exceeded. Rotate the current encoder to select the desired decimal point location. Press the voltage encoder switch to accept the selected decimal point location and return to the “Totalizer Configuration Menu”.
5) Rotate the current encoder until the display shows “tot” “End”, and then press the voltage encoder switch to return to the “Unit Configuration Menu”.
6) If any changes were made in the “Totalizer Configuration Menu” you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.

6.3.2. Host Port Configuration

The host port baud rate and the unit ID are configured in the “Host Port Configuration Menu”. The baud rate is the communications rate in bits per second used by the host port. The unit ID is a unique numeric identification used by the power supply to determine which serial host commands to respond to. When multiple units are connected on a multi-drop RS485 network each power supply should have a unique unit ID so that each power supply can be individually addressed by the connected host.

Use the “Host Port Configuration Menu” to configure the host port. The “Host Port Configuration Menu” is located within the “Unit Configuration Menu (see 6.3.Unit Configuration). Use the following procedure to configure the host port. For more details on the “Host Port Configuration Menu” see A.6.2.Host Port Configuration Menu.

1) From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “HOSt”, and then press the voltage encoder switch to enter the “Host Port Configuration Menu”.
2) From the “Host Port Configuration Menu” rotate the current encoder until the display shows “HOSt” “bAUd”. Then press the voltage encoder switch to view and change the host port baud rate.
3) The host port baud rate is indicated by “bAUd” on the top display and the selected baud rate in kilo bits per second on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the

selected baud rate. Once the desired baud rate is selected press the voltage encoder switch to accept the value and return to the “Host Port Configuration Menu”.

4) From the “Host Port Configuration Menu” rotate the current encoder until the display shows “HOSt” “id”. Then press the voltage encoder switch to view and change the unit ID.

5) The unit ID is indicated by “id” on the top display and the selected unit ID on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the selected unit ID. Once the desired unit ID is selected press the voltage encoder switch to accept the value and return to the “Host Port Configuration Menu”.

6) From the “Host Port Configuration Menu” rotate the current encoder until the display shows “HOSt” “End”. Then press the voltage encoder switch to exit the “Host Port Configuration Menu” and return to the “Unit Configuration Menu”.

7) If any host port settings were changed you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.

6.3.3. Remote Control Configuration

When the power supply is in remote control mode (RMT lamp is on) the current and voltage settings can be set from a remote source. The remote source can be an analog input through an option card or it can be a serial host. The source of these remote settings is set in the “Remote Control Configuration Menu”. The source of the current and voltage settings while in remote control mode can be independently set to the host or the analog option card. Note that the settings in the “Remote Control Configuration Menu” have no affect then the power supply is in local control mode (RMT lamp is off). In local control mode the current and voltage settings can be adjusted from the power supply front panel.

For more details on controlling the current and voltage settings remotely see 7.0.Remote Host Control and 9.0.Remote Analog Control (Option).

If it is desired to remotely control the current or voltage setting from an analog signal connected to an option card then the remote source for the associated signal should be set to the option card. If it is desired to remotely control the current or voltage setting from a serial host then the remote source for the associated signal should be set to the host.

Use the following procedure to configure the source of the current and voltage settings when the power supply is in remote control mode (RMT lamp is on). The “Remote Control Configuration Menu” is located within the “Unit Configuration Menu (see 6.3.Unit Configuration). See A.6.3.Remote Control Configuration Menu for more information regarding the “Remote Control Configuration Menu” navigation.

1) From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “rmt”, and then press the voltage encoder switch to enter the “Remote Control Configuration Menu”.

2) From the “Remote Control Configuration Menu” rotate the current encoder until the display shows “rmt” “I.SEt”. Then press the voltage encoder switch to view and change the source of the current setting in remote mode.

3) The source of the current setting in remote mode is indicated by “dFLt rmt I.SEt” on the top display and the selected source on the bottom display. The SET lamp is blinking on

and off to indicate that a setting is displayed. Rotate the current encoder to change the selected source. Select “HOSt” as the source if the current setting will come from the serial host port when the power supply is in remote mode. Select “OPt” if the source of the current setting will come from an analog input connected to an option card when the power supply is in remote mode. Once the desired source is selected press the voltage encoder switch to accept the value and return to the “Remote Control Configuration Menu”.

4) From the “Remote Control Configuration Menu” rotate the current encoder until the display shows “rmt” “E.SEt”. Then press the voltage encoder switch to view and change the source of the voltage setting in remote mode.
5) The source of the voltage setting in remote mode is indicated by “dFLt rmt E.SEt” on the top display and the selected source on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the selected source. Select “HOSt” as the source if the voltage setting will come from the serial host port when the power supply is in remote mode. Select “OPt” if the source of the voltage setting will come from an analog input connected to an option card when the power supply is in remote mode. Once the desired source is selected press the voltage encoder switch to accept the value and return to the “Remote Control Configuration Menu”.
6) From the “Remote Control Configuration Menu” rotate the current encoder until the display shows “rmt” “End”. Then press the voltage encoder switch to exit the “Remote Control Configuration Menu” and return to the “Unit Configuration Menu”.
7) If any settings were changed you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.

NOTE: The settings in the “Remote Control Configuration Menu” are the default settings used when the unit is powered on. These settings can be changed at any time by a connected host. This makes it possible for a connected host to dynamically change the remote control source between the host and an option card analog input. See Appendix B:Host Port Protocol for more details.

NOTE: If an option card is not installed (see 6.3.8.Hardware Options Configuration to determine if an option card is installed) the source of both the current and voltage settings while in remote mode will be set to the host port. The option card will not be a choice in the “Remote Control Configuration Menu”.

6.3.4. Power On Configuration

The power supply can be configured to always power on in standby mode, or it can be configured to power on in the last mode it was in when it was powered off.

When the power on configuration is set to “Stby” the unit will always power up in standby mode with the output disabled. If a timed cycle (RTC or ATC) was running (in operate) when the unit was powered off the unit will power on in standby-paused mode. The operator can choose to resume or terminate the cycle when the unit is powered on. If a manual cycle was running when the unit was powered off the unit will power on in standby mode.

When the power on configuration is set to “LASt” the unit will power on in the same mode it was in when it powered off. If a timed cycle (RTC or ATC) was running (in operate) when the unit was

powered off then when the unit is powered on it will resume the timed cycle where it left off after a short count down period. The automatic resume can be terminated during the count down period by pressing the operate button. If a timed cycle was paused when the unit was powered off then the unit will power on in the paused state. If a manual cycle was running (in operate) when the unit was powered off then the then when the unit is powered on it will go back into operate mode after a short count down period. The return to operate mode can be terminated during the count down period by pressing the operate button. If the power supply was in standby mode when it was powered off then it will power on in standby mode.

See A.2.Power On/Off Sequences for more details on what is displayed during power on and power off in various power on configurations.

The power on configuration can be changed in the “Unit Start System Menu”. Use the following procedure to change the power on configuration. The “System Configuration Menu” is located within the “Unit Configuration Menu (see 6.3.Unit Configuration). See A.6.4.System Configuration Menu and A.6.4.1.Unit Start System Menu for more information regarding menu navigation.

1) From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “SyS”, and then press the voltage encoder switch to enter the “System Configuration Menu”.
2) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “Strt”, and then press the voltage encoder switch to enter the “Unit Start System Menu”.
3) From the “Unit Start System Menu” rotate the current encoder until the display shows “Strt” “CtrL”, and then press the voltage encoder switch to view and change the power on configuration (or “start control” configuration).
4) The power on configuration (or “start control” configuration) is indicated by displaying “Unit Strt CtrL” on the top display and the selected power on configuration in the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the selected power on configuration. Select “Stby” to configure the unit to always power on in standby mode. Select “LASt” to configure the unit to power on in the same mode it was in when it was powered off. Once the desired configuration is selected press the voltage encoder switch to accept the value and return to the “Unit Start System Menu”.
5) From the “Unit Start System Menu” rotate the current encoder until the display shows “Strt” “End”. Then press the voltage encoder switch to exit the “Unit Start System Menu” and return to the “System Configuration Menu”.
6) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “End”. Then press the voltage encoder switch to exit the “System Configuration Menu” and return to the “Unit Configuration Menu”.
7) If any settings were changed in the “System Configuration Menu” you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.

6.3.5. Power Fail Alarm Configuration

The power supply can be configured to report error codes if power is interrupted while the supply is in operate mode. If the power failure alarms are enabled the appropriate error code (error codes 102 or 103) is set when power fails during operate mode. The error code will remain active

until it is manually cleared, even if the unit is powered on and off multiple times. See Appendix C:Error Codes for a complete list of error codes. See 6.5.Error Messages for details regarding error message display and manual clearing of error codes.

Power failure alarms can be enabled or disabled in the “Unit Start System Menu”. Use the following procedure to enable or disable power failure alarms. The “System Configuration Menu” is located within the “Unit Configuration Menu (see 6.3.Unit Configuration). See A.6.4.System Configuration Menu and A.6.4.1.Unit Start System Menu for more information regarding menu navigation.

1) From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “SyS”, and then press the voltage encoder switch to enter the “System Configuration Menu”.
2) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “Strt”, and then press the voltage encoder switch to enter the “Unit Start System Menu”.
3) From the “Unit Start System Menu” rotate the current encoder until the display shows “Strt” “P.FLt”, and then press the voltage encoder switch to view and change the power failure alarm enable/disable setting.
4) The power failure alarm enable/disable setting is indicated by displaying “Por FAIL FLt” on the top display and the power failure alarm enable/disable setting in the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the power failure alarm enable/disable setting. Select “on” to enable power failure alarms. Select “OFF” to disable power failure alarms. Once the desired configuration is selected press the voltage encoder switch to accept the value and return to the “Unit Start System Menu”.
5) From the “Unit Start System Menu” rotate the current encoder until the display shows “Strt” “End”. Then press the voltage encoder switch to exit the “Unit Start System Menu” and return to the “System Configuration Menu”.
6) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “End”. Then press the voltage encoder switch to exit the “System Configuration Menu” and return to the “Unit Configuration Menu”.
7) If any settings were changed in the “System Configuration Menu” you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.

6.3.6. Remote Operate/Standby Control (Digital Input)

The inhibit input can be used as a digital input to remotely control the operate/standby state. Since the inhibit input is connected to a hardware disable circuit the power supply will always go into standby mode when the inhibit input disables the output.

It is possible to independently configure the actions taken when the inhibit input changes from a hardware enable state (INHIBIT lamp is off) to a hardware disable state (INHIBIT lamp is on) or from a hardware disable state (INHIBIT lamp is on) to a hardware enable state (INHIBIT lamp is off).

Digital Input Start Configuration:

“d.in Strt” = “OFF”	**“d.in Strt” = “on”**
No action is taken when the inhibit input changes from a hardware disable state (INHIBIT lamp is on) to a hardware enable state (INHIBIT lamp is off). **Use this setting when the inhibit input is used as a safety interlock.**	When the inhibit input changes from a hardware disable state (INHIBIT lamp is on) to a hardware enable state (INHIBIT lamp is off) the operate state changes from standby to operate (a new cycle is started if a cycle was not paused, or resumed if the cycle was previously paused). **Use this setting when the inhibit input is used for remote operate/standby control.** **CAUTION:** This setting will cause the unit to go to operate mode any time the INHIBIT lamp goes from an on to a off state.

Digital Input Stop Configuration:

“d.in StoP” = “PAUS”	**“d.in StoP” = “End”**
When the inhibit input changes from a hardware enable state (INHIBIT lamp is off) to a hardware disable state (INHIBIT lamp is on) the currently running cycle is paused and the output is disabled. If “d.in Strt” = “on” the cycle will resume when the inhibit input changes to a hardware enable state. **Use this setting to pause a currently running timed cycles when the inhibit input disables the output.**	When the inhibit input changes from a hardware enable state (INHIBIT lamp is off) to a hardware disable state (INHIBIT lamp is on) the currently running cycle is terminated and the operate state changes to standby. If “d.in Strt” = “on” a new cycle will start when the inhibit input changes to a hardware enable state. **Use this setting to end a currently running timed cycle when the inhibit input disables the output.**

The digital input configuration can be changed in the “Digital Input System Menu”. Use the following procedure to configure the digital input. The “System Configuration Menu” is located within the “Unit Configuration Menu (see 6.3.Unit Configuration). See A.6.4.System Configuration Menu and A.6.4.2.Digital Input System Menu for more information regarding menu navigation.

1) From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “SyS”, and then press the voltage encoder switch to enter the “System Configuration Menu”.
2) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “d.in”, and then press the voltage encoder switch to enter the “Digital Input System Menu”.
3) From the “Digital Input System Menu” rotate the current encoder until the display shows “d.in” “Strt”, and then press the voltage encoder switch to view and change the digital input start configuration.
4) The digital input start configuration is indicated by displaying “d.in CyCL Strt” on the top display and the digital input start configuration in the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the digital input start configuration. Select “OFF” if the inhibit input will be used

as a safety interlock (no action is taken when the inhibit input enables the output, the unit must be put into operate state using the front panel or a host command). Select "on" to use the inhibit input for remote operate/standby control (the unit goes into operate mode when the inhibit input enables the output). Once the desired configuration is selected press the voltage encoder switch to accept the value and return to the "Digital Input System Menu".

5) From the "Digital Input System Menu" rotate the current encoder until the display shows "d.in" "StoP", and then press the voltage encoder switch to view and change the digital input stop configuration.
6) The digital input stop configuration is indicated by displaying "d.in CyCL StoP" on the top display and the digital input stop configuration in the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the digital input stop configuration. Select "PAUS" to pause a currently running timed cycle when the inhibit input disables the output. Select "End" to end a currently running timed cycle when the inhibit input disables the output. Once the desired configuration is selected press the voltage encoder switch to accept the value and return to the "Digital Input System Menu".
7) From the "Digital Input System Menu" rotate the current encoder until the display shows "d.in" "End". Then press the voltage encoder switch to exit the "Digital Input System Menu" and return to the "System Configuration Menu".
8) From the "System Configuration Menu" rotate the current encoder until the display shows "SyS" "End". Then press the voltage encoder switch to exit the "System Configuration Menu" and return to the "Unit Configuration Menu".
9) If any settings were changed in the "System Configuration Menu" you will be prompted to store the changes. Select "yES" to accept the changes or "no" to cancel the changes.

6.3.7. Front Panel Button Lock Outs

The front panel operate and remote buttons can be independently enabled or disabled. It may be desirable to disable (or lock) one or both of these buttons to prevent changes from being made on the front panel when the power supply is being remotely controlled. Note that when the power supply is in remote control mode (RMT lamp is on) settings cannot be changed from the front panel, but the operate state can still be changed by pressing the operate switch on the front panel. To prevent changes to settings or the operate state made from the front panel the power supply can be put into remote control mode (RMT lamp is on) and then both the remote and operate switches can be disabled (locked).

CAUTION: If the operate switch is disabled (locked) the operate state can no longer be changed from the front panel. Operate/standby control must be accomplished using the inhibit input or the host port (see 8.0.Remote Operate/Standby Control for details on how to remotely control the operate/standby state).

The front panel remote and operate button enable/disable state can be changed from the "Button System Menu". Use the following procedure to enable or disable the front panel remote and operate switches. The "System Configuration Menu" is located within the "Unit Configuration

Menu (see 6.3.Unit Configuration). See A.6.4.System Configuration Menu and A.6.4.3.Button System Menu for more information regarding menu navigation.

1) From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “SyS”, and then press the voltage encoder switch to enter the “System Configuration Menu”.
2) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “btn”, and then press the voltage encoder switch to enter the “Button System Menu”.
3) From the “Button System Menu” rotate the current encoder until the display shows “btn” “OPEr”, and then press the voltage encoder switch to view and change the operate button lock state.
4) The operate button lock state is indicated by displaying “OPEr btn LOC” on the top display and the operate button lock state in the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the operate button lock state. Select “yES” to lock (disable) the operate button. Select “no” to unlock (enable) the operate button. Once the desired configuration is selected press the voltage encoder switch to accept the value and return to the “Button System Menu”.
5) From the “Button System Menu” rotate the current encoder until the display shows “btn” “rmt”, and then press the voltage encoder switch to view and change the remote button lock state.
6) The remote button lock state is indicated by displaying “rmt btn LOC” on the top display and the remote button lock state in the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the remote button lock state. Select “yES” to lock (disable) the remote button. Select “no” to unlock (enable) the remote button. Once the desired configuration is selected press the voltage encoder switch to accept the value and return to the “Button System Menu”.
7) From the “Button System Menu” rotate the current encoder until the display shows “btn” “End”. Then press the voltage encoder switch to exit the “Button System Menu” and return to the “System Configuration Menu”.
8) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “End”. Then press the voltage encoder switch to exit the “System Configuration Menu” and return to the “Unit Configuration Menu”.
9) If any settings were changed in the “System Configuration Menu” you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.

6.3.8. Hardware Options Configuration

The “Hardware Options System Menu” is used to configure and enable some hardware options. For example, an installed analog control option card would require the option card setting to be set to “AnL”. See A.6.4.4.Hardware Options System Menu for more details.

6.3.9. Changing the Unit Configuration Password

The unit configuration password is required to gain access to the unit configuration menu (see 6.3.Unit Configuration).

The password can be changed from the “Unit Configuration Access Code System Menu”. Use the following procedure to change the unit configuration password (also referred to as the unit configuration access code). The “System Configuration Menu” is located within the “Unit Configuration Menu (see 6.3.Unit Configuration). See A.6.4.System Configuration Menu and A.6.4.5.Unit Configuration Access Code System Menu for more information regarding menu navigation.

1) From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “SyS”, and then press the voltage encoder switch to enter the “System Configuration Menu”.
2) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “COdE”, and then press the voltage encoder switch to enter the “Unit Configuration Access Code System Menu”.
3) The first screen in the “Unit Configuration Access Code Menu” shows the existing access code value. To change the access code rotate the current encoder to change the selected digit (blinking digit). Each press of the current encoder switch advances the selected digit. After the desired code is entered press the voltage encoder to accept the new access code.
4) If the access code is changed an informational warning message is displayed to indicate that the code has been changed. This screen displays “CHng” on the top display and “COdE” on the bottom display. This screen is displayed for a short period of time and can be skipped by pressing the voltage encoder switch.
5) After the warning message is displayed a confirmation screen is displayed. The top display shows “CHng COdE” and the bottom display shows the confirmation selection. Rotate the current encoder to change the confirmation selection. Select “yES” to accept the access code change or “no” to cancel the change. Press the voltage encoder switch to accept the selection and exit the “Unit Configuration Access Code System Menu” and return to the “System Configuration Menu”.
6) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “End”. Then press the voltage encoder switch to exit the “System Configuration Menu” and return to the “Unit Configuration Menu”.
7) If any settings were changed in the “System Configuration Menu” you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes. You must select “yES” to accept the changes to the access code.

6.3.10. Setting Unit Defaults

All settings in the “Unit Configuration Menu” and the “Unit Setup Menu” can be reset to default values from the “Set Defaults System Menu”. Calibration values are not affected.

Use the following procedure to reset all settings to default values. The “System Configuration Menu” is located within the “Unit Configuration Menu (see 6.3.Unit Configuration). See A.6.4.System Configuration Menu and A.6.4.6.Set Defaults System Menu for more information regarding menu navigation.

1) From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “SyS”, and then press the voltage encoder switch to enter the “System Configuration Menu”.
2) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “dFLt”, and then press the voltage encoder switch to enter the “Set Defaults System Menu”.
3) The first screen in the “Set Defaults System Menu” shows “Set Unit dFLt” on the top display and shows “yES” or “no” on the bottom display. Rotate the current encoder to make a selection. Select “yES” to reset all settings to default values, or select “no” to leave the settings unchanged. Press the voltage encoder switch to accept the selection.
4) If “yES” was selected a warning screen is displayed. The warning screen shows “CHng” on the top display and “ALL” on the bottom display. The warning message is displayed for a short period of time and can be skipped by pressing the voltage encoder switch.
5) After the warning message is displayed a confirmation screen is displayed. The top display shows “CHng ALL to dFLt” and the bottom display shows the confirmation selection. Rotate the current encoder to change the confirmation selection. Select “yES” to reset all settings to default value or “no” to cancel. Press the voltage encoder switch to accept the selection and exit the “Set Defaults System Menu” and return to the “System Configuration Menu”.
6) From the “System Configuration Menu” rotate the current encoder until the display shows “SyS” “End”. Then press the voltage encoder switch to exit the “System Configuration Menu” and return to the “Unit Configuration Menu”.
7) If any settings were changed in the “System Configuration Menu” you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes. You must select “yES” to complete the reset to default values.

6.4. Cycle Control Settings

All cycle control settings are located in the Setup Menu. The Setup Menu can be accessed at any time; however settings cannot be changed while the unit is operating. In addition the settings cannot be changed while in remote control mode (RMT lamp is on). For details on accessing and navigating the Setup Menu see A.5.Unit Setup Menu.

6.4.1. Manual Cycle Control

In manual cycle control the power supply output is enabled and disabled by the operate/standby front panel switch, or the digital input (inhibit input), or through serial host port commands (see 8.0.Remote Operate/Standby Control for details on other methods of operate/standby control). Once the supply is put into the operate state or the standby state it will remain in that state until it is commanded to a different state or power is lost (see 6.3.4:Power On Configuration for details on how to retain the operate state through a power off/on sequence).

To configure the supply for manual cycle control set the cycle control setting to “manual” in the cycle setup menu. Use the following procedure to configure the supply for manual cycle control. See A.5.1.Cycle Setup Menu for details on the cycle setup menu.

1) Enter the “Unit Setup Menu” by pressing and holding both encoder switches until the display shows “Unit” “SEt” (see A.5.Unit Setup Menu for details).
2) Rotate the current encoder until the display shows “SEt” “CyCL”. Then press the voltage encoder switch to enter the “Cycle Setup Menu”.
3) From the “Cycle Setup Menu” rotate the current encoder until the display shows “CyCL” “CtrL”. Then press the voltage encoder switch to view and change the cycle control setting.
4) The cycle control setting is indicated by “CtrL” on the top display and the selected control type on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the cycle control type to manual “mAn”. Once the desired control type is selected press the voltage encoder switch to accept the value and return to the “Cycle Setup Menu”.
5) From the “Cycle Setup Menu” rotate the current encoder until the display shows “CyCL” “End”. Then press the voltage encoder switch to exit the “Cycle Setup Menu” and return to the “Unit Setup Menu”.
6) If any cycle settings were changed you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.
7) From the “Unit Setup Menu” rotate the current encoder until the display shows “SEt” “End”. Press the voltage encoder switch to exit the “Unit Setup Menu”.

6.4.2. Timed Cycle Control (RTC or ATC)

There are two timed cycle control modes. In Real Time Control (RTC) mode an operate cycle runs for a specified period of time, regardless of the current and voltage settings or the supply output. In Amp Time Control (ATC) mode an operate cycle runs until the specified amp time accumulates, as such the actual time that an ATC cycle runs depends on the output current of the supply and the target cycle time.

Once a timed operate cycle is started it will run for the specified period of time (RTC) or amp time (ATC) unless it is commanded to stop or to pause the cycle. When a timed cycle completes the operate state changes to standby (OPER/STBY lamp is off and output is disabled) and the display flashes “EOC” “----“ (EOC on the display indicates End Of Cycle). In addition the EOC status bit is set in the host readings command (see Appendix B:Host Port Protocol for more information regarding the host protocol).

A timed cycle can be initiated, stopped, or paused from the front panel using the operate/standby switch, or by the inhibit input (configurable) or by a serial host port command (see 8.0.Remote Operate/Standby Control for details on other methods of operate/standby control). If power is lost while a timed cycle is running the supply can be configured to automatically resume the cycle when power comes back on or it can be configured to power on in a paused state allowing the operator to decide if the cycle should be terminated or resumed (see 6.3.4:Power On Configuration for details on how to retain the operate state through a power off/on sequence).

To configure the supply for timed cycle control set the cycle control setting to “RTC” or “ATC” and set the desired cycle time in the cycle setup menu. Use the following procedure to configure the supply for RTC or ATC cycle control. See A.5.1.Cycle Setup Menu for details on the cycle setup menu.

1) Enter the “Unit Setup Menu” by pressing and holding both encoder switches until the display shows “Unit” “SEt” (see A.5.Unit Setup Menu for details).
2) Rotate the current encoder until the display shows “SEt” “CyCL”. Then press the voltage encoder switch to enter the “Cycle Setup Menu”.
3) From the “Cycle Setup Menu” rotate the current encoder until the display shows “CyCL” “CtrL”. Then press the voltage encoder switch to view and change the cycle control setting.
4) The cycle control setting is indicated by “CtrL” on the top display and the selected control type on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the cycle control type to “rtc” for RTC control or “Atc” for ATC control. Once the desired control type is selected press the voltage encoder switch to accept the value and return to the “Cycle Setup Menu”.
5) From the “Cycle Setup Menu” rotate the current encoder until the display shows “CyCL” “Unit”. Then press the voltage encoder to view and change the cycle time units.
6) If the cycle control type is set to “rtc” the cycle time units are indicated by “rtc” on the top display and the selected time units on the bottom display. If the control type is set to “Atc” the cycle time units are indicated by “Atc AmP” on the top display and the selected time units on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to select the desired units. Select “min” for RTC minutes or ATC amp minutes and “hr” for RTC hours or ATC amp hours. Once the desired units are selected press the voltage encoder switch to accept the setting and return to the “Cycle Setup Menu”.
7) From the “Cycle Setup Menu” rotate the current encoder until the display shows “CyCL” “dEC”. Then press the voltage encoder switch to view and change the cycle time decimal point location.
8) The cycle time decimal point location is indicated by “dEC” on the top display and the selected decimal point location on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to select the desired decimal point location. The decimal point location affects the resolution of the target cycle time setting and also affects the maximum possible target cycle time setting. The maximum target cycle time setting is 9999, or 999.9, or 99.99, or 9.999, depending on where the decimal location is set to. Once the desired decimal location is set press the voltage encoder switch to accept the setting and return to the “Cycle Setup Menu”.
9) From the “Cycle Setup Menu” rotate the current encoder until the display shows “CyCL” “tArg”. Then press the voltage encoder switch to view and change the target cycle time.
10) When the target cycle time is displayed the top display will indicate the units of the target cycle time. For an RTC cycle with units set to minutes the top display will show “tArg min”. An RTC cycle with units set to hours will display “tArg hr” on the

top display. Likewise an ATC cycle could display “tArg Amp min” or “tArg Amp hr” on the top display. The bottom display will show the currently selected target cycle time. The decimal place and maximum allowed setting will be dependent on the decimal setting made in the preceding steps. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the selected digit (blinking digit). Each press of the current encoder selects the next digit. Once the desired target cycle time is set press the voltage encoder switch to accept the setting and return to the “Cycle Setup Menu”.

11) From the “Cycle Setup Menu” rotate the current encoder until the display shows “CyCL” “End”. Then press the voltage encoder switch to exit the “Cycle Setup Menu” and return to the “Unit Setup Menu”.

12) If any cycle settings were changed you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.

13) From the “Unit Setup Menu” rotate the current encoder until the display shows “SEt” “End”. Press the voltage encoder switch to exit the “Unit Setup Menu”.

6.4.3. Tolerance Settings

The power supply can be configured to report an error code when the current and/or voltage reading is out of tolerance. The out of tolerance error code is displayed on the front panel (see 6.5.Error Messages for details on how error messages are displayed) and is reported in the serial host port alarm status message (see Appendix B:Host Port Protocol for details on the alarm status message). Out of tolerance errors do not affect power supply output or operate/standby state. Once an out of tolerance error is set it will remain set until a new cycle is started or the error is manually cleared (see 6.5.2.Clearing Error Codes for details on manually clearing error codes).

Tolerances are set as a percentage of the associated setting. A tolerance setting of 0% disables out of tolerance error reporting for the associated signal. A current tolerance setting of 10% will cause an out of tolerance error to be set if the current reading differs from the current setting by more than 10%. A current tolerance setting of 10% and a current setting of 10.0 amps would cause a current over tolerance alarm for any current reading greater than 11 amps and would cause a current under tolerance alarm for any current reading less than 9 amps. See Appendix C:Error Codes for a list of possible out of tolerance error codes.

Use the “Tolerance Setup Menu” in the “Unit Setup Menu” to configure tolerance settings. The following procedure describes how to change tolerance settings. See A.5.2.Tolerance Setup Menu for details on the “Tolerance Setup Menu”.

1) Enter the “Unit Setup Menu” by pressing and holding both encoder switches until the display shows “Unit” “SEt” (see A.5.Unit Setup Menu for details).

2) Rotate the current encoder until the display shows “SEt” “tOL”. Then press the voltage encoder switch to enter the “Tolerance Setup Menu”.

3) From the “Tolerance Setup Menu” rotate the current encoder to select either the current or voltage tolerance setting. The top display will show “tOL”, the bottom display will show “Curr” for current tolerance or “UOLt” for voltage tolerance. Once the desired signal is selected press the voltage encoder switch to view and change the associated tolerance setting.

4) The tolerance setting is indicated by “I.tOL” on the top display for current tolerance or “E.tOL” on the top display for voltage tolerance. The selected tolerance in percent is displayed on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to change the selected tolerance digit (blinking on and off). Each press of the current encoder switch selects the next digit. Enter a tolerance value of zero to disable tolerance error reporting. Once the desired tolerance is set press the voltage encoder switch to accept the value and return to the “Tolerance Setup Menu”.

5) To change another tolerance setting repeat the above procedure starting at step 3 above. To exit the “Tolerance Setup Menu” rotate the current encoder until “tOL” “End” is displayed. Then press the voltage encoder switch to exit the “Tolerance Setup Menu” and return to the “Unit Setup Menu”.

6) If any tolerance settings were changed you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes.

7) From the “Unit Setup Menu” rotate the current encoder until the display shows “SEt” “End”. Press the voltage encoder switch to exit the “Unit Setup Menu”.

6.5. Error Messages

The power supply can report various error codes to indicate problems with the power supply or the process.

Most errors provide warnings and information, but do not affect power supply performance. Errors like the over temperature warning (error code 73) or the cooling fan diagnostic error (error code 72) can provide information warning of problems that could lead to power supply failure if not addressed.

The over temperature shut down warning (error code 74) causes the output of the power supply to be shut off to prevent damage to the power supply.

Other errors can provide information about the process. There are out of tolerance errors to report when the current output or voltage output is out of tolerance (see 6.4.3.Tolerance Settings for details on tolerance settings). There are errors to report that power was lost while the power supply was in operate mode (see 6.3.5.Power Fail Alarm Configuration for details on enabling power failure alarms).

For a complete list of errors see Appendix C:Error Codes.

Error messages are displayed while a run screen is active (SET lamp is off). Error messages are not displayed when menus are displayed. When an error becomes active the FAULT lamp turns on and if a run screen is being displayed and the error message display is enabled (it is enabled by default at power on) the display will alternate between the currently selected run screen and a screen showing the active error code. If more than one error code is active the error codes are displayed one at a time, in the order they occurred. See 6.5.1.Error Message Display for details on temporarily disabling the error message display. See 6.5.2.Clearing Error Codes for details on manually clearing error codes.

6.5.1. Error Message Display

The display of the active error codes can be disabled. When the error message display is disabled the error codes are no longer displayed, but the FAULT lamp remains operational. If

error codes remain active after the error message display is disabled the fault lamp remains on until all the active fault codes are cleared. If new error codes are set while the error message display is disabled the FAULT lamp will blink on and off indicating new error codes have been set. When the error message display is disabled active error codes can be viewed from the “Clear Error Menu” (see 6.5.2.Clearing Error Codes), or by using the host protocol alarm status command (see Appendix B:Host Port Protocol).

The error message display can be disabled or enabled from the “Error Handling Setup Menu”. Use the following procedure to enable or disable the display of error messages. See A.5.3.Error Handling Setup Menu for details on the “Error Handling Setup Menu”.

1) Enter the “Unit Setup Menu” by pressing and holding both encoder switches until the display shows “Unit” “SEt” (see A.5.Unit Setup Menu for details).
2) Rotate the current encoder until the display shows “SEt” “Err”. Then press the voltage encoder switch to enter the “Error Handling Setup Menu”.
3) From the “Error Handling Setup Menu” rotate the current encoder to display “Err” “diSP”. Then press the voltage encoder switch to view and change the error display setting.
4) The error display setting is indicated with “Err diSP” displayed on the top display and the error display setting on the bottom display. The SET lamp is blinking on and off to indicate that a setting is displayed. Rotate the current encoder to select the desired setting. Select “on” to enable the display of error messages. Select “OFF” to disable the display of error messages. The default at power on is for error messages to be enabled (“on”). Once the desired error display setting is selected press the voltage encoder switch to accept the setting and return to the “Error Handling Setup Menu”.
5) From the “Error Handling Setup Menu” rotate the current encoder until “Err” “End” is displayed. Then press the voltage encoder switch to exit the “Error Handling Setup Menu” and return to the “Unit Setup Menu”.
6) From the “Unit Setup Menu” rotate the current encoder until the display shows “SEt” “End”. Press the voltage encoder switch to exit the “Unit Setup Menu”.

NOTE: Alternatively a shortcut to the error display setting is provided. This shortcut can be used in place of the numbered procedure above. From any run screen press and hold both encoder switches until the display shows “Err” “diSP”. Release the encoder switches and the top display will show “Err diSP” and the bottom display will indicate “on” or “OFF”. Rotate the current encoder to change the on/off selection. Select “OFF” to disable display of error messages. Press the voltage encoder switch to accept the selection and return to the run screen. If the voltage encoder switch is not pressed and no changes are made to the on/off selection for a short period of time the display will automatically return to the run screen.

NOTE: The display of error messages is enabled (“on”) by default when the unit powers on.

6.5.2. Clearing Error Codes

Most error codes are self clearing when the error condition is corrected. However certain error codes require manual clearing. These error codes are not self clearing because these error codes

provide information about conditions that occurred that may affect the process. An example of error codes that require manual clearing are the power failure error codes (102 and 103). If these error codes are enabled they are set when power is lost while the power supply is operating. When power returns the error codes are set and must be manually cleared. For a complete list of error codes see Appendix C:Error Codes.

Use the following procedure to view and/or clear active error codes. If the error condition still exists after the error code is cleared it will be set again. See A.5.3.Error Handling Setup Menu for details on the "Error Handling Setup Menu".

1) Enter the "Unit Setup Menu" by pressing and holding both encoder switches until the display shows "Unit" "SEt" (see A.5.Unit Setup Menu for details).
2) Rotate the current encoder until the display shows "SEt" "Err". Then press the voltage encoder switch to enter the "Error Handling Setup Menu".
3) From the "Error Handling Setup Menu" rotate the current encoder to display "Err" "CLr". Then press the voltage encoder switch to enter the "Clear Error Menu".
4) The "Clear Error Menu" can be used to view all active error codes, clear individual error codes, or clear all active error codes. The "Clear Error Menu" is indicated by displaying "CLr" on the top display. Rotating the current encoder will scroll through the list of active error codes (bottom display). If no error codes are active the only available selections will be "ALL" and "End". Selecting "ALL" will proceed to screens that allow all active error codes to be cleared. Selecting "End" exits the "Clear Error Menu" and returns to the "Error Handling Setup Menu". Selecting an error code will proceed to screens that allow the selected code to be individually cleared. Once the desired action is selected press the voltage encoder switch to proceed.
5) Selecting "ALL" or an error code from the "Clear Error Menu" will display a confirmation screen. The top display will show the error code, the bottom display will show "yES" or "no". Rotate the current encoder to select "yES" to clear the error code or "no" to leave the error code active.
6) When finished viewing and/or clearing error codes select "End" from the "Clear Error Menu". Press the voltage encoder switch to exit the "Clear Error menu" and return to the "Error Handling Setup Menu".
7) From the "Error Handling Setup Menu" rotate the current encoder until "Err" "End" is displayed. Then press the voltage encoder switch to exit the "Error Handling Setup Menu" and return to the "Unit Setup Menu".
8) From the "Unit Setup Menu" rotate the current encoder until the display shows "SEt" "End". Press the voltage encoder switch to exit the "Unit Setup Menu"

6.6. Run Screens

The power supply display is organized into menus and run screens. Run screens provide information about the supply status, the supply output and other cycle status information. Several run screens are available providing various sets of information. Run screens are used during normal supply operation. The SET lamp is off when a run screen is displayed. See 6.2.Menu Overview for more details on the overall menu and run screen organization.

Use the following proceedure to select which run screen is displayed. The run screen selection is retained through a power cycle (for example, if the meters were displayed when the unit was powered off, then the meters will be displayed when the unit powers on). See A.4.Display Select Menu for details on the "Display Select Menu".

1) Press and hold both encoder switches until the display shows "diSP" "SEL".
2) The "Display Select Menu" is indicated by showing "diSP" on the top display and the currently selected run screen on the bottom display. Rotate the current encoder to select the desired run screen. Then press the voltage encoder switch to exit the "Display Select Menu" and view the selected run screen. Alternatively the "Display Select Menu" will automatically exit and display the selected run screen if no changes are made for several seconds.

6.6.1. Meters Run Screen

The meters run screen is displayed when "mtr" is selected from the "Display Select Menu" (see 6.6.Run Screens for details on using the "Display Select Menu"). The meters run screen shows the voltage meter on the top display and the current meter on the bottom display. The SET lamp is off when the meters are displayed.

The current or voltage setting can be displayed and changed by pressing the associated encoder switch. The SET lamp will flash on and off when one or both settings are displayed. When a setting is displayed the selected digit (blinking) can be adjusted by rotating the associated encoder. Each press of the associated encoder switch advances the selected digit. When no changes are made to the settings for a short period of time the display returns to the meter values (SET lamp is off).

When the power supply is in operate mode and the meters are displayed (SET lamp is off) rotating an encoder will adjust the least significant digit of the associated setting. The affect of the change will be reflected by the associated meter if the output value changes.

The current and voltage settings cannot be adjusted while the power supply is in remote control mode (RMT lamp is on).

6.6.2. Totalizer Run Screen

The totalizer run screen is displayed when "tot" is selected from the "Display Select Menu" (see 6.6.Run Screens for details on using the "Display Select Menu"). The top display indicates the totalizer units and which portion of the totalizer is being displayed. Since the totalizer maximum value is 99999999 (decimal point location is dependent on the totalizer settings) only half of the totalizer value is displayed at a time. Rotating the voltage encoder while the totalizer run screen is displayed will switch the bottom display between the upper ("Hi") four digits and the lower ("Lo") four digits of the totalizer value. The totalizer accumulates any time there is current output by the power supply. The SET lamp is off when the totalizer run screen is displayed. See 6.3.1.Totalizer Configuration for details on how to configure and clear the totalizer.

The following table shows various totalizer run screen messages.

Top Display Text	Totalizer Units	Totalizer digits displayed
"tot AmP min Lo"	Amp Minutes	4 least significant digits
"tot AmP min Hi"	Amp Minutes	4 most significant digits
"tot AmP Hr Lo"	Amp Hours	4 least significant digits

“tot AmP Hr Hi”	Amp Hours	4 most significant digits

6.6.3. Cycle Run Screen

The cycle run screen is displayed when “CyCL” is selected from the “Display Select Menu” (see 6.6.Run Screens for details on using the “Display Select Menu”). The cycle run screen shows a count down of the time remaining in the currently running or paused timed cycle (RTC or ATC). The top display indicates the type of cycle (RTC or ATC) and the units of the cycle time. The bottom display shows time remaining in the currently running or paused cycle.

The target cycle time setting can be viewed or changed from the cycle run screen (note that the target cycle time setting can also be changed from the cycle setup menu). Pressing the current encoder will display the target cycle time (SET lamp is flashing on and off). When the target cycle time is displayed the currently selected digit (blinking) can be changed by rotating the current encoder. Each press of the voltage encoder advances the selected digit. When no changes are made to the target cycle time for a short period of time the display returns to the time remaining in the cycle. The target cycle time cannot be changed while the power supply is in operate mode (OPER/STBY lamp is on), and the target cycle time cannot be changed while the power supply is in remote control mode (RMT lamp is on).

See 6.4.2.Timed Cycle Control (RTC or ATC) for details on timed cycle settings.

The following table shows various cycle run screen messages.

Top Display Text	Cycle Type	Cycle time units
“rtc min”	RTC	Minutes
“rtc Hr”	RTC	Hours
“Atc amp min”	ATC	Amp Minutes
“Atc amp Hr”	ATC	Amp Hours
“mAn”	Manual	N/A

6.6.4. Diagnostics Run Screen

The diagnostics run screen is displayed when “diAg” is selected from the “Display Select Menu” (see 6.6.Run Screens for details on using the “Display Select Menu”). The diagnostics run screen shows the internal power supply heat sink temperature in degrees C or degrees F, or it shows the cooling fan speed in percent. When the diagnostics run screen is displayed rotating the voltage encoder will change between the heat sink temperature display and the fan speed display. When the heat sink display is shown rotating the current encoder changes between degrees C and degrees F.

If a temperature sensor failure has been detected the heat sink temperature display will not display a temperature but rather it will display “Err”. If a temperature sensor failure is detected the temperature sensor failure error code (error code 75) will be set as well.

If a problem is detected with the cooling fan the cooling fan error code (error code 72) is set and the commanded fan speed is set to 100%. Even though the fan is commanded to full speed when a cooling fan error condition is detected the cooling fan may not be operating due to a cooling fan component failure. The cooling fan operation should be checked when the cooling fan error code is active.

If a temperature sensor error or cooling fan error is detected the associated error code will be displayed and the FAULT lamp will be on regardless of which run screen is currently displayed (see 6.5.Error Messages for details on how error codes are reported). The diagnostics run screen does not need to be active for these fault conditions to be detected, the diagnostics run screen simply provides more detailed information.

6.7. Current and Voltage Settings

The current and voltage settings can be adjusted from the “Meter Run Screen”. To view the “Meter Run Screen” press and hold both encoder switches until the display shows “diSP” “SEL”. Then rotate the current encoder until the display shows “diSP” “mtr”. Then press the voltage encoder to view the meters. The “Meter Run Screen” will show the voltage and current meters (numeric values on the top and bottom display) and the SET lamp will be off. See 6.6.Run Screens for details on using the display select menu.

6.7.1. Voltage Setting Adjustment

From the “Meter Run Screen” press the voltage encoder switch to view and/or change the voltage setting. When the voltage encoder switch is pressed from the “Meter Run Screen” the voltage setting is displayed, as indicated by the flashing SET lamp. Rotate the voltage encoder to change the currently selected voltage setting digit. Each press of the voltage encoder switch selects the next voltage setting digit (the blinking digit is the currently selected digit). After no changes are made to the voltage setting for a short period of time the display will return to the voltage meter value (the SET lamp will be off when both the current and voltage meters are displayed). See 6.6.1.Meters Run Screen for more information on displaying the “Meter Run Screen” and adjusting the voltage setting.

The voltage setting can be adjusted during operate or standby mode, but cannot be changed in remote control mode (RMT lamp is on).

The voltage setting can also be adjusted while in operate mode and viewing the voltage meter value (rather than viewing the voltage setting as described above). While the meter value is displayed (SET lamp is off) and the power supply is in operate mode rotating the voltage encoder will change the least significant digit of the voltage setting. The affects of the change will be seen by changes in the meter value as the output changes.

6.7.2. Current Setting Adjustment

From the “Meter Run Screen” press the current encoder switch to view and/or change the current setting. When the current encoder switch is pressed from the “Meter Run Screen” the current setting is displayed, as indicated by the flashing SET lamp. Rotate the current encoder to change the currently selected current setting digit. Each press of the current encoder switch selects the next current setting digit (the blinking digit is the currently selected digit). After no changes are made to the current setting for a short period of time the display will return to the current meter value (the SET lamp will be off when both the current and voltage meters are displayed). See 6.6.1.Meters Run Screen for more information on displaying the “Meter Run Screen” and adjusting the current setting.

The current setting can be adjusted during operate or standby mode, but cannot be changed in remote control mode (RMT lamp is on).

The current setting can also be adjusted while in operate mode and viewing the current meter value (rather than viewing the current setting as described above). While the meter value is

displayed (SET lamp is off) and the power supply is in operate mode rotating the current encoder will change the least significant digit of the current setting. The affects of the change will be seen by changes in the meter value as the output changes.

6.8. Setting Adjustment and Regulation Modes

The LT SERIES DC rectifier can be set to current, voltage or crossover regulation. Current/voltage limits can be set with the front panel controls. The following procedures outline the necessary steps:

NOTE: Make sure the unit is in local mode. The RMT indicator should be off. If it is on, press the RMT / LCL button to turn it off.

6.8.1. Setting Adjustment (while viewing the setting)

The voltage and current settings are adjusted from the meters run screen by using the associated encoder as described in 6.7.Current and Voltage Settings. From operate or standby mode pushing an encoder switch will display the associated setting (the 'SET' lamp blinks on and off). If the setting can be changed, the active digit will flash. Turning the encoder will adjust the flashing digit. Each press of the encoder switch will advance the active digit by one digit to the left. When no more adjustments are made after a short period the display will automatically change back to the appropriate meter value and the 'SET' lamp turns off.

6.8.2. Setting Adjustment (while viewing the output value)

From operate mode minor adjustments to the output of the power supply can be made while viewing the voltage or current meter values (setting is not displayed). While in operate mode turning the appropriate encoder (without pushing the encoder switch) will make minor adjustments to the power supply output (the lowest setting digit is being adjusted). The change in output will be reflected on the associated meter. Note that adjustments made in this manner will affect the setting even though the setting is not displayed.

6.8.3. Current Regulation

1. Set the VOLTAGE setting to its maximum value using the voltage encoder (the maximum value will be the rating of the supply).

   NOTE: The fastest way to adjust a setting to maximum or minimum is to press the encoder button until the left-most digit is flashing and then turn the encoder.

2. Set the CURRENT setting to the desired value using the current encoder.
3. When regulating current, if the current reaches the supply current rating level the supply will change to voltage regulation to keep the current from going over its rating.

6.8.4. Voltage Regulation

1. Set the CURRENT setting to its maximum value using the current encoder (the maximum value will be the rating of the supply).
2. Set the VOLTAGE setting to the desired value using the voltage encoder.
3. When regulating voltage, if the voltage reaches the supply voltage rating level the supply will change to current regulation to keep the voltage from going over its rating.

6.8.5. Current Regulation with Voltage Limit (crossover)

1. Use the voltage encoder to adjust the VOLTAGE setting to the desired voltage limit. For proper setting of the voltage limit make sure the SET lamp is blinking on and off while making the adjustment (if the SET lamp is not blinking on and off then the value displayed is not the voltage setting but rather the output voltage meter value, which indicates actual voltage on the output, not the voltage limit setting).
2. Use the current encoder to adjust the CURRENT setting to the desired current. For proper setting of the current setting make sure the SET lamp is blinking on and off while making the adjustment.
3. During operation if the bath resistance goes up the voltage will increase until it reaches the voltage limit. The power supply will then switch to voltage regulation to keep the voltage from going over the limit. The current will then decrease as the bath resistance increases.

   NOTE: The current and voltage settings can be viewed at any time by pressing the associated encoder switch (the SET lamp will blink on and off).

6.8.6. Voltage Regulation with Current Limit (crossover)

1. Use the current encoder to adjust the CURRENT setting to the desired current limit. For proper setting of the current limit make sure the SET lamp is blinking on and off while making the adjustment (if the SET lamp is not blinking on and off then the value displayed is not the current setting but rather the output current meter value, which indicates actual current on the output, not the current limit setting).
2. Use the VOLTAGE encoder to adjust the VOLTAGE setting to the desired voltage. For proper setting of the voltage setting make sure the SET lamp is blinking on and off while making the adjustment.
3. During operation if the bath resistance goes down the current will increase until it reaches the current limit. The power supply will then switch to current regulation to keep the current from going over the limit. The voltage will then decrease as the bath resistance decreases.

   NOTE: The current and voltage settings can be viewed at any time by pressing the associated encoder switch (the SET lamp will blink on and off).

6.9. Cycle Pause/Resume using the OPER/STBY Switch

A timed cycle (RTC or ATC) can be paused at any time by pressing the operate switch while the cycle is running. When the operate switch is pressed the display will change to “PAUS” “End”. This informational screen indicates that the cycle has been paused. Pressing the operate button a second time while the display shows “PAUS” “End” will end the cycle. A paused cycle is indicated when the OPER lamp blinks on and off. The output is disabled when a cycle is paused.

A paused cycle (indicated by the OPER lamp blinking on and off) can be resumed at any time by pressing the operate button one time. When the operate button is pressed the display will show “PAUS” End”. Rotate the current encoder to change the display to “PAUS” “Cont” and then press the operate button again to resume (continue) the cycle.

A paused cycle (indicated by the OPER lamp blinking on and off) can be terminated at any time by pressing the operate button two times. When the operate button is pressed the first time the display will show “PAUS” “End”. Pressing the operate button a second time ends the cycle.

See A.3Cycle Pause/Resume for details on the screens shown when pausing and resuming cycles.

Cycles can be paused and resumed by the inhibit input or a host serial command as well (see 8.0.Remote Operate/Standby Control).

7. Remote Host Control

7.1. Overview

The LT SERIES DC rectifier can be controlled by a host (computer, plc, etc) using the RS485 host port and the ASCII host protocol defined in Appendix B:Host Port Protocol. The host port can be used to monitor the settings or read back values at any time. The host port can only modify settings if the unit is in Remote mode (RMT indicator is on). The Remote mode is entered by pressing the Remote switch.

7.2. Host Port Communications Settings

The host port settings include a Unit ID (1 to 99) and Baud Rate (9600, 19200, 38400, 57600, 115200). If more than one power supply is connected on a multi-drop network each power supply must have a unique unit ID so that it can be individually addressed.

The host port settings are displayed momentarily at power up after the version information is displayed. The host port ID is displayed on the voltage display and the baud rate is displayed in kilobits per second on the current display. The following would be displayed on the meters for a unit having an ID of 01 and baud rate of 115200.

The host port baud rate and the host unit ID can be set using the host port protocol as defined in Appendix B: or they can be changed by using the power supply front panel with the instructions in 6.3.Unit Configuration and 6.3.2.Host Port Configuration.

7.3. Host Port Connections

See the 5.5.Serial Host Port Connections for the host port connection diagram.

7.4. Host Port Protocol

An ASCII based protocol provides access to all power supply settings for complete power supply control through the host port connection. Multiple power supplies on a multi-drop RS485 network can be individually addressed. See Appendix B:Host Port Protocol for details.

8. Remote Operate/Standby Control

The power supply operate/standby mode can be remotely controlled by using a digital input (inhibit input) or the host port. See 7.0.Remote Host Control for details on using the host port to control the power supply.

See 5.4.Inhibit Signal Connection for details on connections required for remote operate/standby control using the inhibit signal input. See 6.3.6.Remote Operate/Standby Control (Digital Input) for details on configuring the power supply to use the inhibit input for remote operate/standby control.

When the inhibit input becomes active (INHIBIT lamp is on) the power supply output is disabled and the power supply mode is changed to standby mode. A timed cycle (RTC or ATC) will either be terminated or paused, depending on the configuration as defined in 6.3.6.Remote Operate/Standby Control (Digital Input).

When the inhibit input is configured for remote operate/standby control the power supply will always enable the output and go to operate mode when the inhibit input changes from an inhibit state (INHIBIT lamp is on) to and enabled state (INHIBIT lamp is off). If a timed cycle (RTC or ATC) was paused it will resume when the power supply goes back into operate mode.

9. Remote Analog Control (Option)

Analog control and monitoring requires an optional analog control card. If the unit was shipped with the analog control option card from the factory it should be properly configured to use the option card, see 6.3.8.Hardware Options Configuration for details on configuring an option card.

Analog control is used when the power supply is put into remote control mode (RMT lamp is on) and the source of the current and/or voltage settings is set to option card control (as opposed to being set to host control). See 6.3.3.Remote Control Configuration for details on selecting the option card for remote control.

See 5.6.Analog Card Connections (Optional 138-0471-XX Card) for proper for analog control connections.

NOTE: The host can dynamically switch between analog control and host control if desired. See B.1.12.Setup Command "s": and B.1.17User Settings Command "t": for more information.

NOTE: The local/remote mode will be retained through a power cycle. See 6.3.4.Power On Configuration for information on how to retain the operate/standby mode through a power cycle.

9.1. Remote Analog Read Back

The current and voltage readings from the LT SERIES DC rectifier can be monitored using the analog outputs on the analog control card. The option card analog outputs will always reflect the current and voltage readings. The analog outputs are proportional to the readings as shown in the following tables.

9.1.1. Analog Output Scaling

Analog Output Level Range

Analog I/O Type	Minimum	Maximum
4 to 20mA	4mA	20mA
0 to 5V	0.0V	5V
0 to 10V	0.0V	10V

Analog Output Scaling

Unit Reading	Analog Output Level
0.0 (volts or amps)	Minimum
Supply Rating (volts or amps)	Maximum

9.2. Remote Analog Setting Control

The LT SERIES DC rectifier's voltage and current settings can be controlled through the analog option card when the power supply is in remote mode (indicated by the RMT lamp being on) and the source of the current and/or voltage settings is set to option card control (see 6.3.3.Remote Control Configuration). The RMT/LCL switch is used to change to the remote mode. When the power supply is in remote mode the voltage and current settings cannot be adjusted from the front panel. The unit output levels are proportional to the analog input levels as shown in the following tables.

NOTE: The local/remote mode will be retained through a power cycle. See 6.3.4.Power On Configuration for information on how to retain the operate/standby mode through a power cycle.

9.2.1. Analog Input Scaling

Analog Input Level Range

Analog I/O Type	Minimum	Maximum
4 to 20mA	4mA	20mA
0 to 5V	0.0V	5V
0 to 10V	0.0V	10V

Analog Input Scaling

Analog Input Level	Unit Setting
Minimum	0.0 (volts or amps)
Maximum	Supply Rating (volts or amps)

The regulation modes described in 6.8.3.Current Regulation, 6.8.4.Voltage Regulation, 6.8.5.Current Regulation with Voltage Limit (crossover), and 6.8.6.Voltage Regulation with Current Limit (crossover) also apply to remote operation.

9.3. Remote Operate/Standby for Analog Control

See 8.0.Remote Operate/Standby Control for methods that can be used for remote operate/standby control.

10. Calibration Procedure

All calibration procedures must be performed by a qualified service technician.

Review the entire procedure before starting.

LT1200X Series

CALIBRATION

10.1. Overview

All calibration steps are performed using the LT front panel interface. The calibration values are written to non-volatile memory where they are retained permanently. The number of calibration steps required depends on the configuration of the unit.

Calibration accuracy is measured by certified test equipment connected externally, and the supply enclosure does not have to be entered. All calibrations are performed by digitally scaling inputs and outputs.

10.1.1. Equipment

Calibration equipment required are a meter, a current shunt and a load as described below. If the optional Analog Control card is being calibrated then a calibrator (Ronan model x86 or equiv.) is required.

Meter(s)

One or two calibrated Digital Volt Meters (DVMs) of at least 4.5 digit resolution and 0.01% overall accuracy. Using 2 meters is faster when switching from current to voltage calibration but is not required.

Current Shunt

A certified shunt with a temperature coefficient of no more than 5 ppm should be used. It is recommended that a 100 mV shunt which is rated at an even power of ten (1A, 10A, etc.) be used. This will require less conversion of the meter reading, requiring only decimal point placement. The rating of the shunt should be at least 1.5 times greater than the current rating of the power supply. Certified shunts are available from most shunt manufacturers including:

EMPRO MANUFACTURING COMPANY INC.

P.O.BOX 26060

INDIANAPOLIS, IN. 46226

PHONE: (317) 823-4478

www.emproshunts.com

Part Number - MLA-100-100 for a 100mV/100Amp Shunt

Loads

The load should be a resistor or set of resistors of approximately twice the required wattage to prevent injury to personnel or equipment and to prevent significant temperature drift. The resistor size is calculated so both the current and voltage can be calibrated with the same load. This can be done because the calibration for the high end values takes place at 95% of rating. An adjustable carbon pile load works well.

EXAMPLE LOAD CALCULATION:

Power supply rating is 12-100 or 12 Volts at 100 Amps.

The voltage developed across load should be approximately 12 volts at 100 amps current. To determine the resistor value use Ohms law:

12Volts / 100Amps = 0.12 ohms

To determine the wattage use:

12 volts x 100 amps = 1200 watts

To calibrate the unit it will be necessary to connect a load resistor with a value of 0.12 ohms and 2400 watts (twice calculated wattage).

Optional Load Method (lower power resistors, 1200W vs. 2400W)

This method uses 2 different load values. When chosen properly the same set of resistors can be rewired to work for both current and voltage calibration.

When calibrating the current settings, a value should be chosen which allows approximately 50% of the voltage at the rated current of the power supply.

When calibrating the voltage settings, the value should allow for 50% of the current at the rated voltage of the power supply. An adjustable carbon pile load works well.

Example Load Calculations:

Power supply rating is 12-100 or 12 Volts at 100 Amps.

Current Calibration Load: The voltage developed across the load should be approximately 6 volts at 100 amps average current. To determine the resistor value use Ohms law:

6 Volts / 100 Amps = 0.06 ohms

To determine the wattage use:

6 Volts x 100 Amps = 600 watts

To calibrate the current settings it will be necessary to connect a load resistor with a value of 0.06 ohms and 1200 watts (twice calculated wattage).

Voltage Calibration Load: The current developed across the load should be 50 amps at 12 volts. To determine the resistor value use Ohms law:

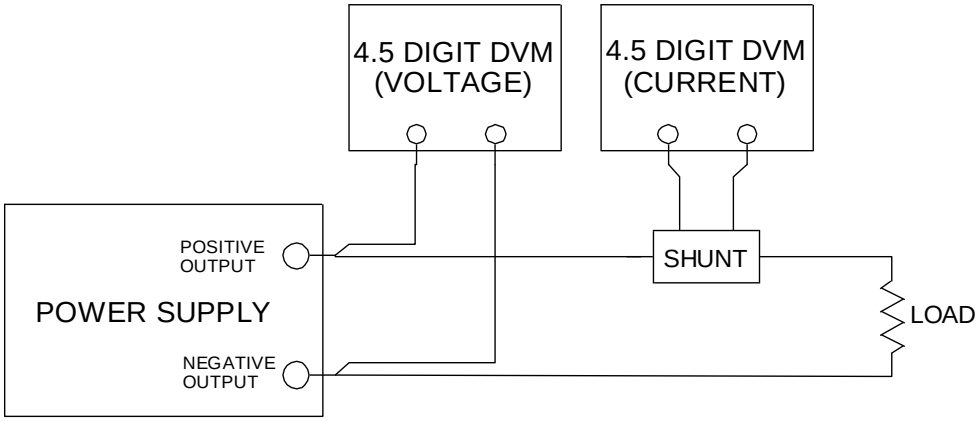
12 Volts / 50 Amps = 0.24 ohms

To determine the wattage use:

12 volts x 50 amps = 600 watts

To calibrate the voltage settings it will be necessary to connect a load resistor with a value of 0.24 ohms and 1200 watts (twice calculated wattage).

10.1.2. Calibration Summary



1. Connect the calibration load, shunt and meters to the output of the power supply as shown above.
2. Select the “CAL” sub menu from the “Unit Configuration Menu” (see 6.3.Unit Configuration) to enter the “Calibrate Configuration Menu”.
3. There are two separate calibrations available in the “Calibrate Configuration Menu” (see A.6.5.Calibrate Configuration Menu for more information regarding the calibration menus). Select “LCL” (local) to calibrate the front panel read back meters and the power supply output. Select “OPt” to calibrate the option card (if an option card is installed).
4. Each calibration menu contains a “dFLt” option to load calibration defaults. Loading default calibration values will remove any previously stored calibration values and reset all the associated calibration values to default values. The default calibration values are not customized to each unit and will not likely provide operation within the product specification. Each power supply must be properly calibrated to operate within the product specifications. Units are not shipped with default calibration values, each unit is individually calibrated at the factory.
5. Each calibration menu contains a series of calibration points. Calibration points should be performed in numerical order as described in the calibration procedure. The calibration values for any calibration point can be viewed at any time without changing the values (select “no” when prompted to store changes).

6. After completing a calibration the calibration values should be saved by selecting “yES” when prompted to store changes. The calibration values are stored to permanent memory and will be retained through power on and power off cycles.

Cal Point	Calibration Menu Display	Calibration point(s) Description
	“LCL” Calibration (Read back meters and output)	
CL01	“I.Hi Out CL01”	Upper current output
CL02	“I.Hi mtr CL02”	Upper current read back meter
CL03	“I.Lo Out CL03”	Lower current output
CL04	“I.Lo mtr CL04”	Lower current read back meter
CL05	“E.Hi Out CL05”	Upper voltage output
CL06	“E.Hi mtr CL06”	Upper voltage read back meter
CL07	“E.Lo Out CL07”	Lower voltage output
CL08	“E.Lo mtr CL08”	Lower voltage read back meter
	“OPt” Calibration (Analog Option Card)	
CL09	“I.Hi CtL CL09”	Upper analog current control input (optional)
CL10	“I.Hi rEAd CL10”	Upper analog current reading output (optional)
CL11	“I.Lo CtL CL11”	Lower analog current control input (optional)
CL12	“I.Lo rEAd CL12”	Lower analog current reading output (optional)
CL13	“E.Hi CtL CL13”	Upper analog voltage control input (optional)
CL14	“E.Hi rEAd CL14”	Upper analog voltage reading output (optional)
CL15	“E.Lo CtL CL15”	Lower analog voltage control input (optional)
CL16	“E.Lo rEAd CL16”	Lower analog voltage reading output (optional)

10.1.3. Restoring the default calibration values

The default calibration values can be restored with the following procedure.

CAUTION: Restoring the default calibration values will cause any previous calibration values to be overwritten. A calibration must be performed after loading the default calibration points by following the calibration procedure in order to get accurate output levels.

1. From the “Unit Configuration Menu” rotate the current encoder until the display shows “CFg” “CAL”. Press the voltage encoder switch to enter the “Calibrate Configuration Menu”. See A.6.Unit Configuration Menu and A.6.5.Calibrate Configuration Menu for more details on menu navigation.
2. From the “Calibrate Configuration Menu” rotate the current encoder to select the desired calibration menu. Select “LCL” for the local current and voltage meters and current and voltage output. Select “OPt” for the analog option card inputs and outputs.
3. From the calibration menu rotate the current encoder until the display shows “dFLt” on the bottom display. Press the voltage encoder switch to proceed with loading default calibration values.
4. The default calibration confirmation screen shows “dFLt” on the top display and “yES” or “np” on the bottom display. Rotate the current encoder to select “yES” and press the voltage encoder switch to load the calibration default values.
5. Proceed with a normal calibration.

10.2. Calibration Steps

10.2.1. Current Output and Read Back Calibration

This sequence sets the calibration values for the current output and the current read back meter.

NOTE: The existing calibration values can be viewed without changing them by leaving the supply in STANDBY mode (OPER indicator is off) and by selecting “no” if prompted to store changes.

1. Connect the appropriate load and shunt for current calibration as determined in Section 10.1.1 and show in the diagram in section 10.1.2.
2. Enter the “Local Calibration Menu” as defined in Section 10.1.2 (“LCL” calibration). The calibration menu contains a “dFLt” sub menu to load default calibration values (see 10.1.3.Restoring the default calibration values) and it contains sub menu selections for each calibration point (CL01 to CL08). Each calibration point should be calibrated in numerical order (first calibrate CL01, then CL02, and so on until CL08 is calibrated). The calibration points can be viewed in any order at any time (remain in STANBY mode to view calibration points, calibration points are not changed while the unit is in STANDBY). The chart in section 10.1.2 describes each calibration point and the text displayed for each point.
3. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “CL01”. Press the voltage encoder switch to view and change CL01 (upper current output calibration point). When CL01 is viewed the top display will show “I.Hi Out CL01”. The bottom display shows the calibration value.
4. When calibrating the upper current output (CL01) the power supply output will be enabled at approximately 95% of the current rating. Verify the proper load connections before proceeding.
5. Press the “OPER” switch to enable the power supply output.
6. Use the current encoder to adjust the output so that the volt meter across the shunt reads the proper value for 95% of the average current rating. Calculate using - **unit current rating x shunt voltage / shunt current x 0.95**
7. There are two ways to end the calibration of CL01. The first way is to press the OPER switch and return to standby mode (OPER/STBY lamp is off) and then press the voltage encoder to return to the “Local Calibration Menu”. If this method is used to end CL01 then proceed with step 8 below to calibrate CL02. Optionally it is possible to automatically calibrate CL02 before ending CL01. To automatically calibrate CL02 press the voltage encoder switch while the unit is still in operate mode (OPER/STBY lamp is on), the display will momentarily change to “…” while CL02 is calibrated and then the unit will change to standby mode (OPER/STBY lamp is off) and will return to the “Local Calibration Menu”.
8. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “CL02”. Press the voltage encoder switch to view and change CL02 (upper current meter calibration point). When CL02 is viewed the top display will show “I.Hi mtr CL02”. The bottom display shows the calibration value.
9. When calibrating the upper current meter calibration point (CL02) the power supply output will be enabled at approximately 95% of the current rating. Verify the proper load connections before proceeding. The upper current output (CL01) must be calibrated prior to calibrating CL02.

10. Press the “OPER” switch to enable the power supply output. The calibration value for CL02 is updated automatically and displayed on the bottom display. After the calibration value stabilizes press the voltage encoder switch to accept the new calibration value and return to the “Local Calibration Menu” (the voltage encoder switch must be pressed while in operate mode to accept the change to CL02). Optionally you can press the OPER switch and return to standby mode (OPER/STBY lamp is off) to cancel the change to CL02 and return the calibration value to its original value. Press the voltage encoder switch to return to the “Local Calibration Menu”.
11. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “CL03”. Press the voltage encoder switch to view and change CL03 (lower current output calibration point). When CL03 is viewed the top display will show “I.Lo Out CL03”. The bottom display shows the calibration value.
12. When calibrating the lower current output (CL03) the power supply output will be enabled at approximately 10% of the current rating. Verify the proper load connections before proceeding.
13. Press the “OPER” switch to enable the power supply output.
14. Use the current encoder to adjust the output so that the volt meter across the shunt reads the proper value for 10% of the average current rating. Calculate using - **unit current rating x shunt voltage / shunt current x 0.10**
15. There are two ways to end the calibration of CL03. The first way is to press the OPER switch and return to standby mode (OPER/STBY lamp is off) and then press the voltage encoder to return to the “Local Calibration Menu”. If this method is used to end CL03 then proceed with step 16 below to calibrate CL04. Optionally it is possible to automatically calibrate CL04 before ending CL03. To automatically calibrate CL04 press the voltage encoder switch while the unit is still in operate mode (OPER/STBY lamp is on), the display will momentarily change to “…” while CL04 is calibrated and then the unit will change to standby mode (OPER/STBY lamp is off) and will return to the “Local Calibration Menu”.
16. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “CL04”. Press the voltage encoder switch to view and change CL04 (lower current meter calibration point). When CL04 is viewed the top display will show “I.Lo mtr CL04”. The bottom display shows the calibration value.
17. When calibrating the lower current meter calibration point (CL04) the power supply output will be enabled at approximately 10% of the current rating. Verify the proper load connections before proceeding. The lower current output (CL03) must be calibrated prior to calibrating CL04.
18. Press the “OPER” switch to enable the power supply output. The calibration value for CL04 is updated automatically and displayed on the bottom display. After the calibration value stabilizes press the voltage encoder switch to accept the new calibration value and return to the “Local Calibration Menu” (the voltage encoder switch must be pressed while in operate mode to accept the change to CL04). Optionally you can press the OPER switch and return to standby mode (OPER/STBY lamp is off) to cancel the change to CL04 and return the calibration value to its original value. Press the voltage encoder switch to return to the “Local Calibration Menu”.

19. To continue with the voltage output and read back calibration go to 10.2.2.Voltage Output and Read Back Calibration. To save changes to the current output and read back calibration and exit the calibration menu proceed with step 20 below.
20. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “End”. Press the voltage encoder switch to exit the “Local Calibration Menu” and return to the “Calibrate Configuration Menu”.
21. If changes were made to any calibration values you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes to the calibration values.

10.2.2. Voltage Output and Read Back Calibration

This sequence sets the calibration points for the voltage output and the voltage read back meter.

NOTE: The existing calibration values can be viewed without changing them by leaving the supply in STANDBY mode (OPER indicator is off) and by selecting “no” if prompted to store changes.

1. Connect the appropriate load and shunt for current calibration as determined in Section 10.1.1 and show in the diagram in section 10.1.2.
2. Enter the “Local Calibration Menu” as defined in Section 10.1.2 (“LCL” calibration). The calibration menu contains a “dFLt” sub menu to load default calibration values (see 10.1.3.Restoring the default calibration values) and it contains sub menu selections for each calibration point (CL01 to CL08). Each calibration point should be calibrated in numerical order (first calibrate CL01, then CL02, and so on until CL08 is calibrated). The calibration points can be viewed in any order at any time (remain in STANBY mode to view calibration points, calibration points are not changed while the unit is in STANDBY). The chart in section 10.1.2 describes each calibration point and the text displayed for each point.
3. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “CL05”. Press the voltage encoder switch to view and change CL05 (upper voltage output calibration point). When CL05 is viewed the top display will show “E.Hi Out CL05”. The bottom display shows the calibration value
4. When calibrating the upper voltage output (CL05) the power supply output will be enabled at approximately 95% of the voltage rating. Verify the proper load connections before proceeding.
5. Press the “OPER” switch to enable the power supply output.
6. Use the current encoder to adjust the output so that the volt meter across the output terminals reads the proper value for 95% of the voltage rating. Calculate using - **unit voltage rating x 0.95**
7. There are two ways to end the calibration of CL05. The first way is to press the OPER switch and return to standby mode (OPER/STBY lamp is off) and then press the voltage encoder to return to the “Local Calibration Menu”. If this method is used to end CL05 then proceed with step 8 below to calibrate CL06. Optionally it is possible to automatically calibrate CL06 before ending CL05. To automatically calibrate CL06 press the voltage encoder switch while the unit is still in operate mode (OPER/STBY lamp is on), the display will momentarily change to “…” while CL06 is calibrated and then the unit will change to standby mode (OPER/STBY lamp is off) and will return to the “Local Calibration Menu”.

8. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “CL06”. Press the voltage encoder switch to view and change CL06 (upper volt meter calibration point). When CL06 is viewed the top display will show “E.Hi mtr CL06”. The bottom display shows the calibration value.
9. When calibrating the upper volt meter calibration point (CL06) the power supply output will be enabled at approximately 95% of the voltage rating. Verify the proper load connections before proceeding. The upper voltage output (CL05) must be calibrated prior to calibrating CL06.
10. Press the “OPER” switch to enable the power supply output. The calibration value for CL06 is updated automatically and displayed on the bottom display. After the calibration value stabilizes press the voltage encoder switch to accept the new calibration value and return to the “Local Calibration Menu” (the voltage encoder switch must be pressed while in operate mode to accept the change to CL06). Optionally you can press the OPER switch and return to standby mode (OPER/STBY lamp is off) to cancel the change to CL06 and return the calibration value to its original value. Press the voltage encoder switch to return to the “Local Calibration Menu”.
11. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “CL07”. Press the voltage encoder switch to view and change CL07 (lower voltage output calibration point). When CL07 is viewed the top display will show “E.Lo Out CL07”. The bottom display shows the calibration value.
12. When calibrating the lower voltage output calibration point (CL07) the power supply output will be enabled at approximately 10% of the voltage rating. Verify the proper load connections before proceeding.
13. Press the “OPER” switch to enable the power supply output.
14. Use the current encoder to adjust the output so that the volt meter across the output terminals reads the proper value for 10% of the unit voltage rating. Calculate using - **unit voltage rating x 0.10**
15. There are two ways to end the calibration of CL07. The first way is to press the OPER switch and return to standby mode (OPER/STBY lamp is off) and then press the voltage encoder to return to the “Local Calibration Menu”. If this method is used to end CL07 then proceed with step 16 below to calibrate CL08. Optionally it is possible to automatically calibrate CL08 before ending CL07. To automatically calibrate CL08 press the voltage encoder switch while the unit is still in operate mode (OPER/STBY lamp is on), the display will momentarily change to “…” while CL08 is calibrated and then the unit will change to standby mode (OPER/STBY lamp is off) and will return to the “Local Calibration Menu”.
16. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “CL08”. Press the voltage encoder switch to view and change CL08 (lower volt meter calibration point). When CL08 is viewed the top display will show “E.Lo mtr CL08”. The bottom display shows the calibration value.
17. When calibrating the lower volt meter calibration point (CL08) the power supply output will be enabled at approximately 10% of the voltage rating. Verify the proper load connections before proceeding. The lower voltage output (CL07) must be calibrated prior to calibrating CL08.

18. Press the “OPER” switch to enable the power supply output. The calibration value for CL08 is updated automatically and displayed on the bottom display. After the calibration value stabilizes press the voltage encoder switch to accept the new calibration value and return to the “Local Calibration Menu” (the voltage encoder switch must be pressed while in operate mode to accept the change to CL08). Optionally you can press the OPER switch and return to standby mode (OPER/STBY lamp is off) to cancel the change to CL08 and return the calibration value to its original value. Press the voltage encoder switch to return to the “Local Calibration Menu”.
19. From the “Local Calibration Menu” rotate the current encoder until the display shows “CAL” “End”. Press the voltage encoder switch to exit the “Local Calibration Menu” and return to the “Calibrate Configuration Menu”.
20. If changes were made to any calibration values you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes to the calibration values.

10.2.3. Analog Calibration (Optional)

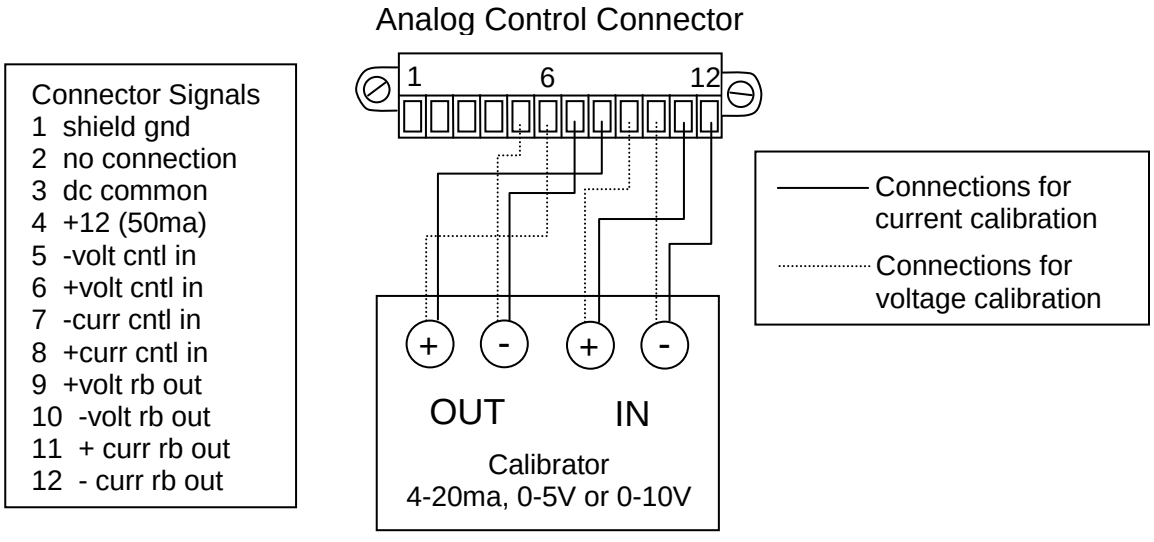
If the optional analog control interface is installed in the power supply, follow this procedure to calibrate it.

NOTE: The existing calibration values can be viewed without changing them by leaving the supply in LOCAL mode (RMT/LCL lamp is off) and by selecting “no” if prompted to store changes.

NOTE: When calibrating the analog interface, there will be no current or voltage on the .output of the power supply. This procedure calibrates the analog interface circuitry.

NOTE: If an option card is not installed (as determined by the unit configuration, see 6.3.8.Hardware Options Configuration) the option card calibration menu will display “no” “OPt”. The calibration steps will not be available.

10.2.3.1. Analog Calibration Connections



Connections for Analog Calibration

10.2.3.2. Analog Calibration Procedure

This sequence sets the calibration values for the optional analog interface.

.

1. From the “Calibrate Configuration Menu” rotate the current encoder until the display shows “CAL” “OPt”. Press the voltage encoder switch to enter the “Option Card Calibration Menu” (see A.6.5.Calibrate Configuration Menu and A.6.5.2.Option Card Calibration Menu for more information regarding menu navigation). The calibration menu contains a “dFLt” sub menu to load default calibration values (see 10.1.3.Restoring the default calibration values) and it contains sub menu selections for each calibration point (CL09 to CL16). Each calibration point should be calibrated in numerical order (first calibrate CL09, then CL10, and so on until CL16 is calibrated). The calibration points can be viewed in any order at any time (remain in local control mode to view calibration points, calibration points are not changed while the unit is in local control mode (RMT lamp is off)). The chart in section 10.1.2 describes each calibration point and the text displayed for each point.
2. Connect the calibrator (Ronan model x86 or equiv.) to the Analog Control connector of the power supply as shown above for the current calibration connections (connect the calibrator output to the analog current control input on the LT, connect the calibrator input to the LT analog current read back output). The calibrator should be set to a range that will maximize resolution for a 20mA signal for a 4-20mA interface (5v for 0-5v interface or 10v for 0-10v interface).
3. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “CL09”. Press the voltage encoder switch to view and change the upper current control analog input calibration point. The top display will show “I.Hi CtL CL09”, the bottom display shows the calibration point value.
4. Set the calibrator output to 20mA (5V for 0-5V or 10V for 0-10V).
5. Put the supply in REMOTE mode (press the RMT/LCL switch so that the RMT/LCL lamp is on) to begin calibrating the upper current control analog input calibration point.
6. The upper current control analog input calibration value (CL09) is automatically updated to reflect the connected calibrator output. Wait a few seconds for the calibration value to stabilize and then press the voltage encoder switch to accept the new value and return to the “Option Card Calibration Menu”.
7. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “CL10”. Press the voltage encoder switch to view and change the upper current read back analog output calibration point. The top display will show “I.Hi rEAd CL10”, the bottom display shows the calibration point value.
8. Put the supply in REMOTE mode (press the RMT/LCL switch so that the RMT/LCL lamp is on) to begin calibrating the upper current read back analog output calibration point.
9. Adjust the current encoder until the calibrator input reads the proper value for 100% of the analog output control signal (20mA for 4-20mA or 5V for 0-5V or 10V for 0-10V).
10. Press the voltage encoder switch to accept the new calibration value and return to the “Option Card Calibration Menu”.

11. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “CL11”. Press the voltage encoder switch to view and change the lower current control analog input calibration point. The top display will show “I.Lo CtL CL11”, the bottom display shows the calibration point value.
12. Set the calibrator output to 10% of the analog input range (5.6mA for 4-20mA or 0.5V for 0-5V or 1V for 0-10V).
13. Put the supply in REMOTE mode (press the RMT/LCL switch so that the RMT/LCL lamp is on) to begin calibrating the lower current control analog input.
14. The lower current control analog input calibration value (CL11) is automatically updated to reflect the connected calibrator output. Wait a few seconds for the calibration value to stabilize and then press the voltage encoder switch to accept the new value and return to the “Option Card Calibration Menu”.
15. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “CL12”. Press the voltage encoder switch to view and change the lower current read back analog output calibration point. The top display will show “I.Lo rEAd CL12”, the bottom display shows the calibration point value.
16. Put the supply in REMOTE mode (press the RMT/LCL switch so that the RMT/LCL lamp is on) to begin calibrating the lower current read back analog output calibration point.
17. Adjust the current encoder until the calibrator input reads the proper value for 10% of the analog output control signal (5.6mA for 4-20mA or 0.5V for 0-5V or 1V for 0-10V).
18. Press the voltage encoder switch to accept the new calibration value and return to the “Option Card Calibration Menu”.
19. Connect the calibrator (Ronan model x86 or equiv.) to the Analog Control connector of the power supply as shown above for the voltage calibration connections (connect the calibrator output to the analog voltage control input on the LT, connect the calibrator input to the LT analog voltage read back output). The calibrator should be set to a range that will maximize resolution for a 20mA signal for a 4-20mA interface (5v for 0-5v interface or 10v for 0-10v interface).
20. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “CL13”. Press the voltage encoder switch to view and change the upper voltage control analog input calibration point. The top display will show “E.Hi CtL CL13”, the bottom display shows the calibration point value.
21. Set the calibrator output to 20mA (5V for 0-5V or 10V for 0-10V).
22. Put the supply in REMOTE mode (press the RMT/LCL switch so that the RMT/LCL lamp is on) to begin calibrating the upper voltage control analog input calibration point.
23. The upper voltage control analog input calibration value (CL13) is automatically updated to reflect the connected calibrator output. Wait a few seconds for the calibration value to stabilize and then press the voltage encoder switch to accept the new value and return to the “Option Card Calibration Menu”.
24. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “CL14”. Press the voltage encoder switch to view and change the upper voltage read back analog output calibration point. The top display will show “E.Hi rEAd CL14”, the bottom display shows the calibration point value.

25. Put the supply in REMOTE mode (press the RMT/LCL switch so that the RMT/LCL lamp is on) to begin calibrating the upper voltage read back analog output calibration point.
26. Adjust the current encoder until the calibrator input reads the proper value for 100% of the analog output control signal (20mA for 4-20mA or 5V for 0-5V or 10V for 0-10V).
27. Press the voltage encoder switch to accept the new calibration value and return to the “Option Card Calibration Menu”.
28. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “CL15”. Press the voltage encoder switch to view and change the lower voltage control analog input calibration point. The top display will show “E.Lo CtL CL15”, the bottom display shows the calibration point value.
29. Set the calibrator output to 10% of the analog input range (5.6mA for 4-20mA or 0.5V for 0-5V or 1V for 0-10V).
30. Put the supply in REMOTE mode (press the RMT/LCL switch so that the RMT/LCL lamp is on) to begin calibrating the lower voltage control analog input calibration point.
31. The lower voltage control analog input calibration value (CL15) is automatically updated to reflect the connected calibrator output. Wait a few seconds for the calibration value to stabilize and then press the voltage encoder switch to accept the new value and return to the “Option Card Calibration Menu”.
32. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “CL16”. Press the voltage encoder switch to view and change the lower voltage read back analog output calibration point. The top display will show “E.Lo rEAd CL16”, the bottom display shows the calibration point value.
33. Put the supply in REMOTE mode (press the RMT/LCL switch so that the RMT/LCL lamp is on) to begin calibrating the lower voltage read back analog output calibration point.
34. Adjust the current encoder until the calibrator input reads the proper value for 10% of the analog output control signal (5.6mA for 4-20mA or 0.5V for 0-5V or 1V for 0-10V).
35. Press the voltage encoder switch to accept the new calibration value and return to the “Option Card Calibration Menu”.
36. From the “Option Card Calibration Menu” rotate the current encoder until the display shows “CAL” “End”. Press the voltage encoder switch to exit the “Option Card Calibration Menu”.
37. If changes were made to any calibration values you will be prompted to store the changes. Select “yES” to accept the changes or “no” to cancel the changes to the calibration values.

11. Optional Features and Controls

This LT1200X Series DC Rectifier may be supplied with any of the following optional features and controls.

11.1. Analog Control Card

This option card provides the ability to control the voltage and current settings of the supply using analog inputs to the option card and to monitor voltage and current read back values using the analog outputs from the card.

Analog option cards are available with 4-20mA, 0-5V, or 0-10V analog signals.

138-0471-00 ASSY. 4-20mA ANALOG INTERFACE

138-0471-01 ASSY. 0-5V ANALOG INTERFACE

138-0471-02 ASSY. 0-10V ANALOG INTERFACE

See section 5.6, for connections.

See section 9.0 for more information on using the analog control option.

See section 10.0 for analog card calibration.

12. Maintenance

12.1. Cleaning

The exterior of this power supply may be cleaned using a damp cloth and a water/detergent solution.

Clean air inlet and air exit as needed to prevent build up of debris using compressed air or a vacuum.

Do not allow an excess build up of dust and debris to accumulate on the unit as the power supply may run hotter and signal and over-temperature alarm or go into standby mode.

Failing to follow cleaning and maintenance procedures may void the warranty and reduce the life of the power supply.

12.2. Filter Replacement (if equipped)

Turn off power supply. Unsnap black filter cover located on the back of the power supply, remove cover and foam filter. Do not remove the four fan guard screws. Discard foam filter and replace with a new foam filter. Ensure foam filter is properly seated in cover. Snap cover and foam filter back onto power supply. Failure to use a Dynatronix supplied filter may reduce the life of the power supply and void the warranty.

12.3. Cooling Fan Replacement

Only replace fan with a Dynatronix supplied replacement. Failure to use a Dynatronix supplied fan may create an electrical hazard, reduce life of the power supply and void the warranty.

A qualified technician is required to replace the fan.

Turn off power supply and disconnect AC power.

Remove the four screws which secure Fan Cover & Rear Air Vent (Air Filter, if equipped), see figure in section

5.2.

Note the fan orientation and cooling direction.

1.) Gently pull fan out of housing until the black and red wire is exposed.

2.) Gently pull on wire to expose fan connector which is secured by Velcro inside the unit.

3.) Unplug and discard old fan.

4.) Clean any debris inside tunnel using compressed air or a vacuum.

5.) Plug in new fan.

6.) Secure connector back inside the housing by pressing the Velcro side up to mate with the Velcro located inside the housing. You should feel a snap when the Velcro is properly seated.

7.) Slide fan back into housing. NOTE: Ensure fan is reinstalled in the same orientation and cooling direction as the fan that was removed.

8.) Reinstall Fan Cover & Rear Air Vent (Air Filter, if equipped). See figure in section 5.2.

9.) Reinstall and tighten the four screws. Do not over tighten.

10.) Plug in AC power cord.

11.) Turn on power supply and verify fan spins freely.

12.) Verify that cooling is from front to rear if unit does not have an air filter.

13.) Verify that cooling is from rear to front if unit does have and air filter.

Appendix A: Menu Tree

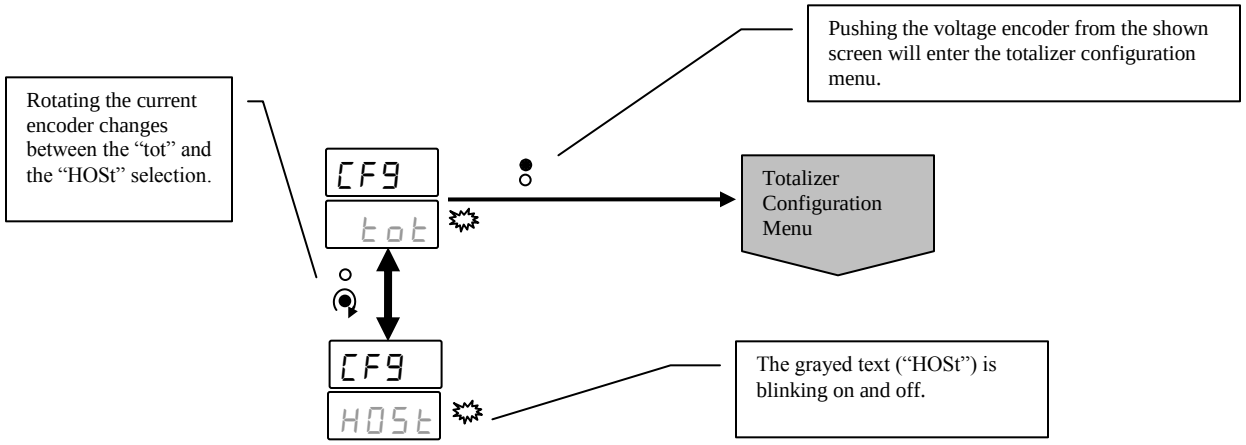
A.1 Menu Tree Format
A.2 Power On/Off Sequences
A.2.1 Power On in Standby
A.2.2 Power On Resume Cycle
A.3 Cycle Pause/Resume
A.4 Display Select Menu
A.5 Unit Setup Menu
A.5.1 Cycle Setup Menu
A.5.2 Tolerance Setup Menu
A.5.3 Error Handling Setup Menu
A.6 Unit Configuration Menu
A.6.1 Totalizer Configuration Menu
A.6.2 Host Port Configuration Menu
A.6.3 Remote Control Configuration Menu
A.6.4 System Configuration Menu
A.6.4.1 Unit Start System Menu
A.6.4.2 Digital Input System Menu
A.6.4.3 Button System Menu
A.6.4.4 Hardware Options System Menu
A.6.4.5 Unit Configuration Access Code System Menu
A.6.4.6 Set Defaults System Menu
A.6.5 Calibrate Configuration Menu
A.6.5.1 Local Calibration Menu
A.6.5.2 Option Card Calibration Menu

A.1 Menu Tree Format

Symbol Definitions

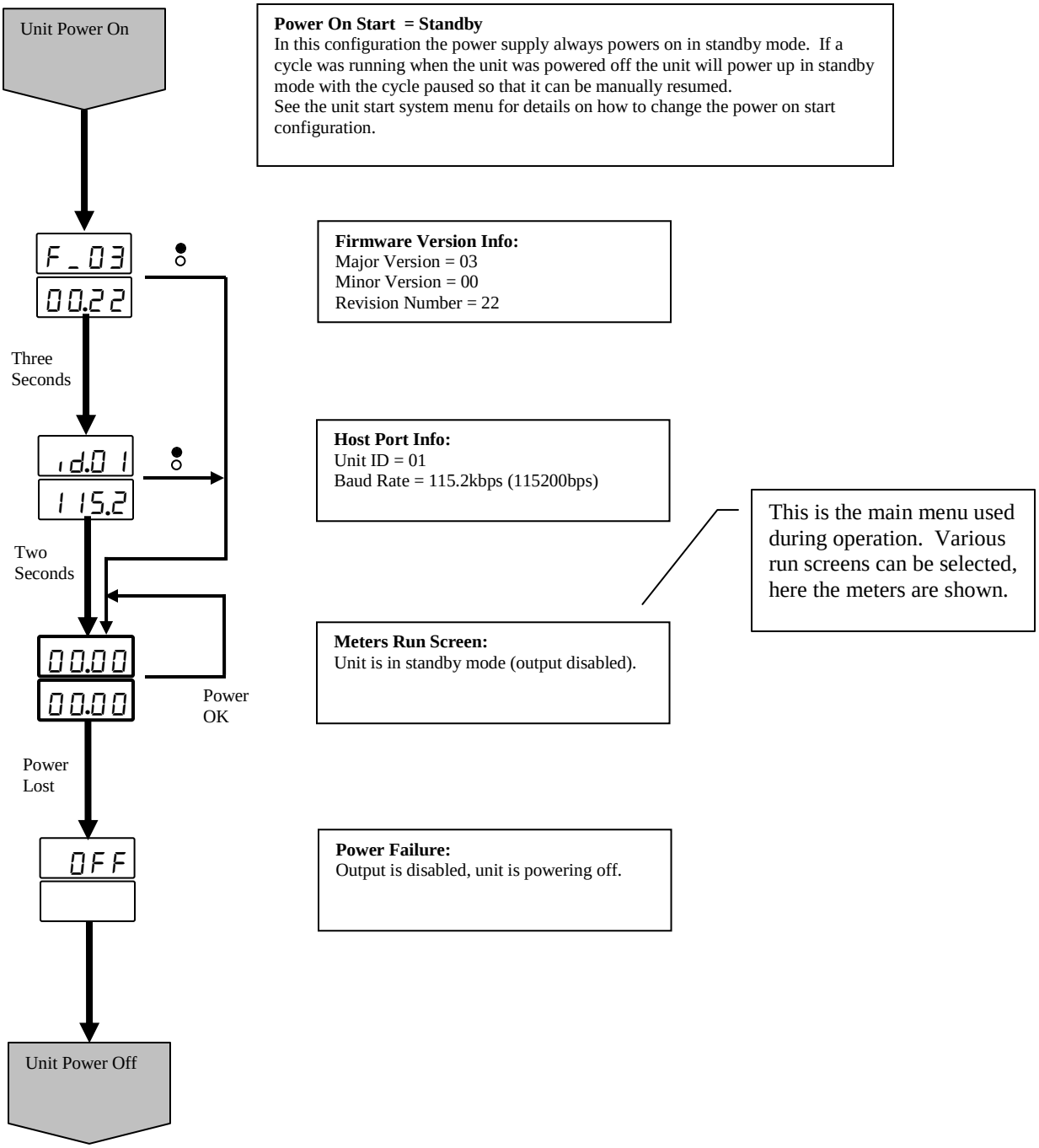
	Indicates rotating the associated encoder. The location of this symbol indicates which encoder switch is being referenced.
	Indicates pushing the associated encoder switch. The location of this symbol indicates which encoder switch is being referenced.
	Indicates no action is taken to the associated encoder switch. The location of this symbol indicates which encoder switch is being referenced.
	Indicates the grayed text in the associated display is blinking on and off. A display that blinks on and off indicates a parameter that can be changed.
	Used to indicate the next screen in a multi-screen message. In a multi-screen message the display will show a short phrase by alternating text one word at a time. This symbol is used to show the order of the screens displayed.

Example

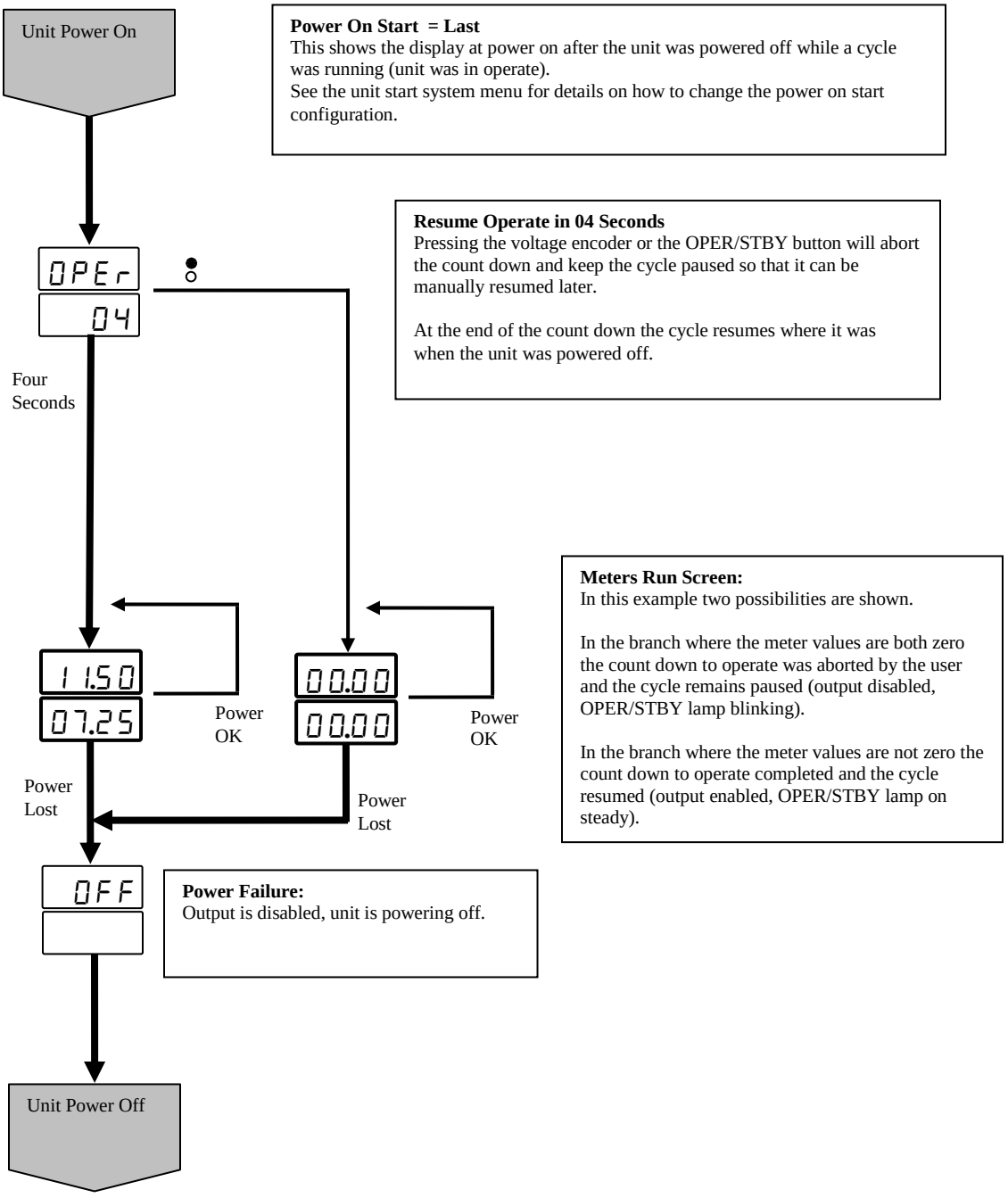

Pushing the voltage encoder from the shown screen will enter the totalizer configuration menu.
Rotating the current encoder changes between the "tot" and the "HOSt" selection.
CFG
tot
Totalizer Configuration Menu
CFG
HOSt
The grayed text ("HOSt") is blinking on and off.

A.2 Power On/Off Sequences

A.2.1 Power On in Standby


Unit Power On
F_03
00.22
Three Seconds
id.01
115.2
Two Seconds
00.00
00.00
Power OK
Power Lost
OFF
Unit Power Off
Power On Start = Standby
In this configuration the power supply always powers on in standby mode. If a cycle was running when the unit was powered off the unit will power up in standby mode with the cycle paused so that it can be manually resumed.
See the unit start system menu for details on how to change the power on start configuration.
Firmware Version Info:
Major Version = 03
Minor Version = 00
Revision Number = 22
Host Port Info:
Unit ID = 01
Baud Rate = 115.2kbps (115200bps)
This is the main menu used during operation. Various run screens can be selected, here the meters are shown.
Meters Run Screen:
Unit is in standby mode (output disabled).
Power Failure:
Output is disabled, unit is powering off.

A.2.2 Power On Resume Cycle



Power On Start = Last
This shows the display at power on after the unit was powered off while a cycle was running (unit was in operate).
See the unit start system menu for details on how to change the power on start configuration.

Resume Operate in 04 Seconds
Pressing the voltage encoder or the OPER/STBY button will abort the count down and keep the cycle paused so that it can be manually resumed later.

At the end of the count down the cycle resumes where it was when the unit was powered off.

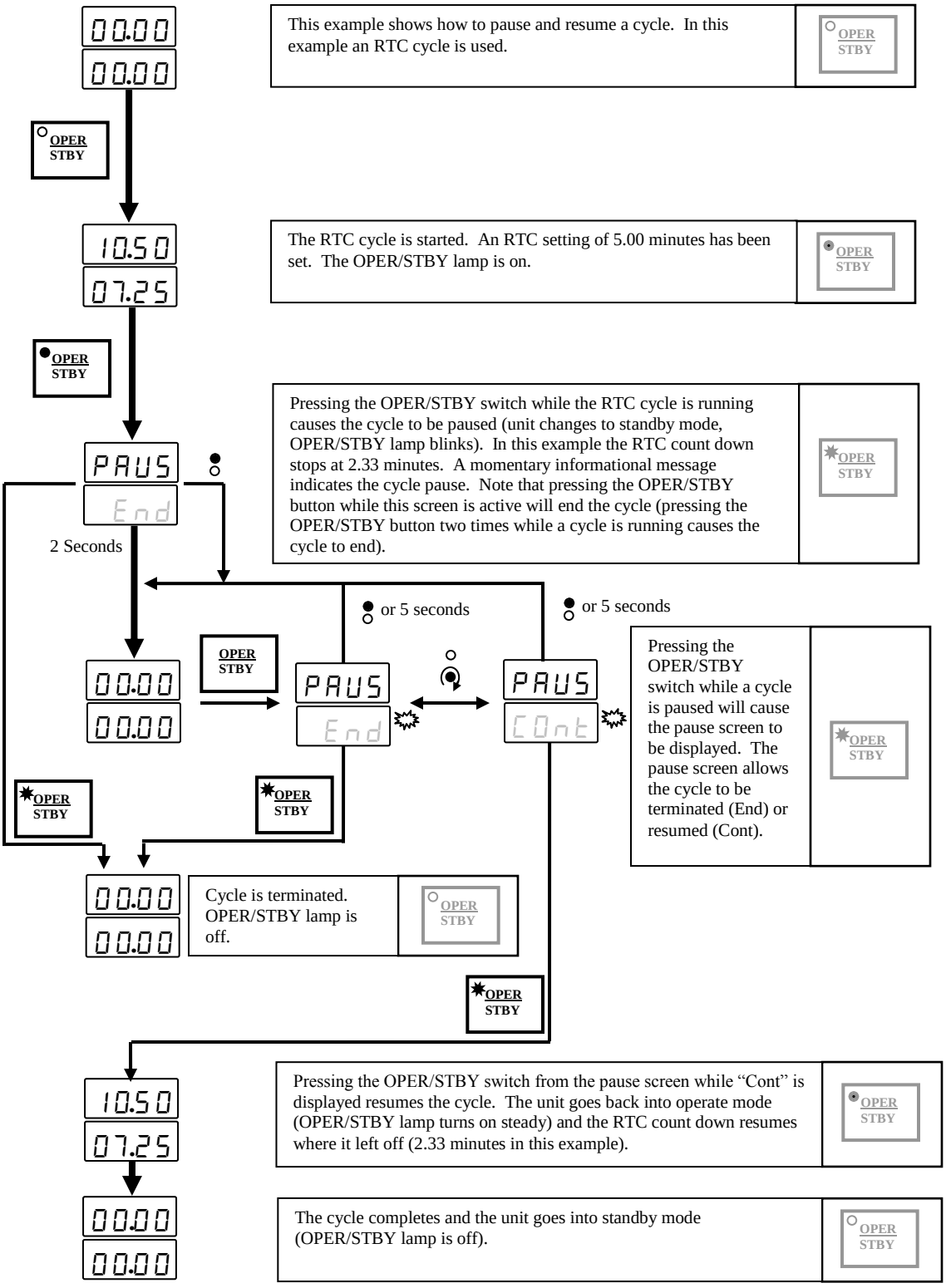
Meters Run Screen:
In this example two possibilities are shown.

In the branch where the meter values are both zero the count down to operate was aborted by the user and the cycle remains paused (output disabled, OPER/STBY lamp blinking).

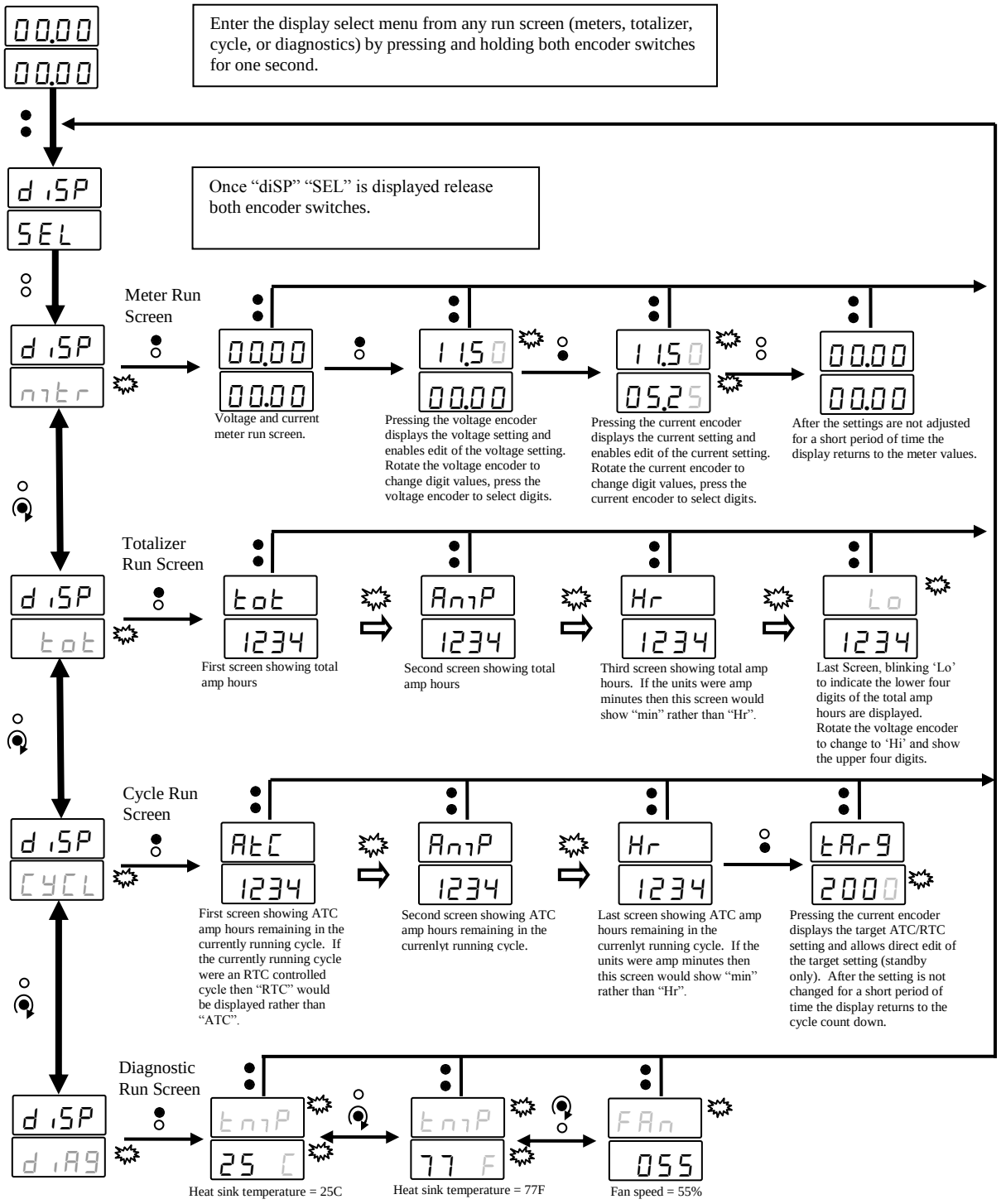
In the branch where the meter values are not zero the count down to operate completed and the cycle resumed (output enabled, OPER/STBY lamp on steady).

Power Failure:
Output is disabled, unit is powering off.

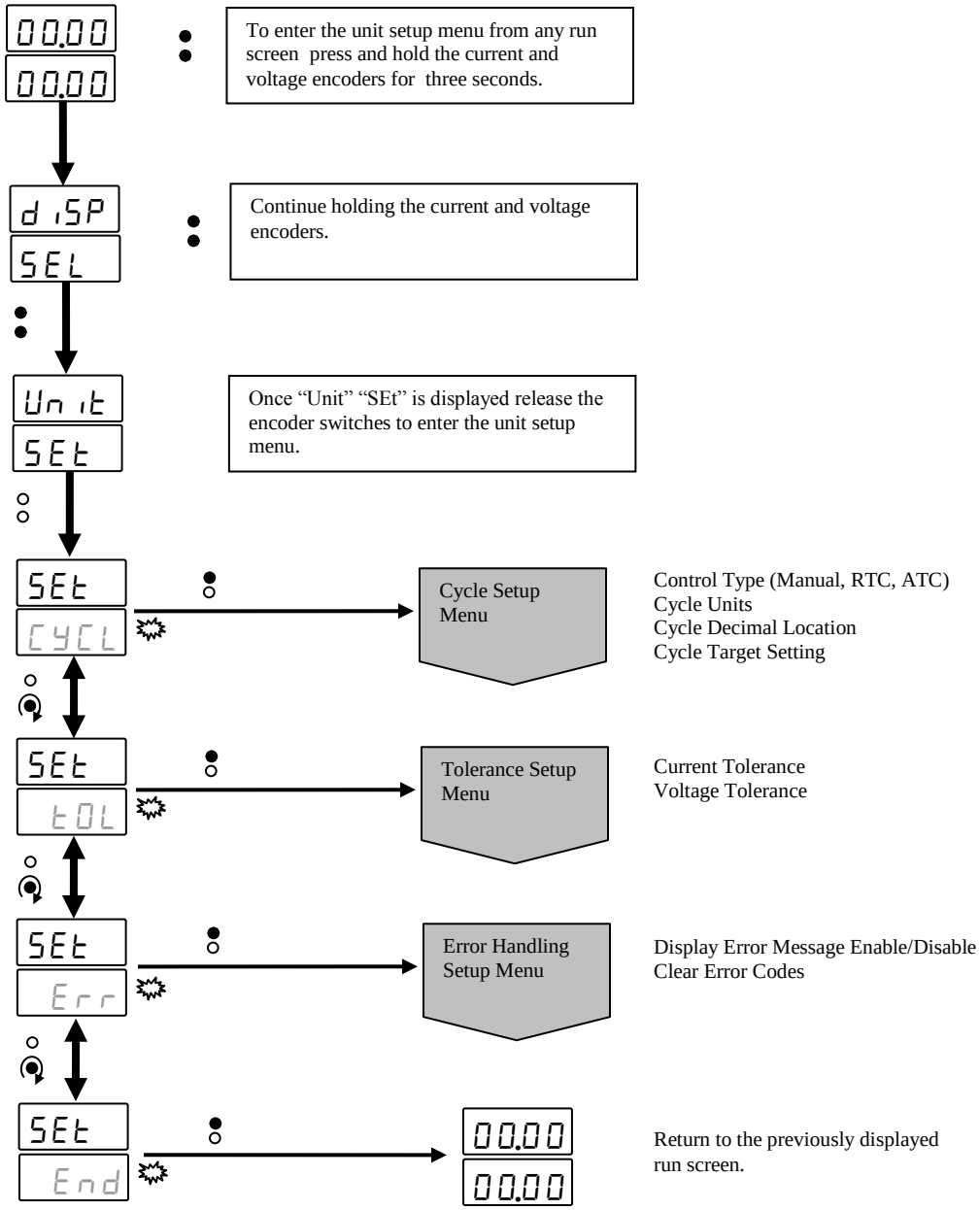
A.3 Cycle Pause/Resume


00.00
00.00
OPER STBY
This example shows how to pause and resume a cycle. In this example an RTC cycle is used.
10.50
07.25
The RTC cycle is started. An RTC setting of 5.00 minutes has been set. The OPER/STBY lamp is on.
PAUS
End
Pressing the OPER/STBY switch while the RTC cycle is running causes the cycle to be paused (unit changes to standby mode, OPER/STBY lamp blinks). In this example the RTC count down stops at 2.33 minutes. A momentary informational message indicates the cycle pause. Note that pressing the OPER/STBY button while this screen is active will end the cycle (pressing the OPER/STBY button two times while a cycle is running causes the cycle to end).
2 Seconds
or 5 seconds
or 5 seconds
PAUS
End
PAUS
CONt
Pressing the OPER/STBY switch while a cycle is paused will cause the pause screen to be displayed. The pause screen allows the cycle to be terminated (End) or resumed (Cont).
Cycle is terminated. OPER/STBY lamp is off.
Pressing the OPER/STBY switch from the pause screen while "Cont" is displayed resumes the cycle. The unit goes back into operate mode (OPER/STBY lamp turns on steady) and the RTC count down resumes where it left off (2.33 minutes in this example).
The cycle completes and the unit goes into standby mode (OPER/STBY lamp is off).

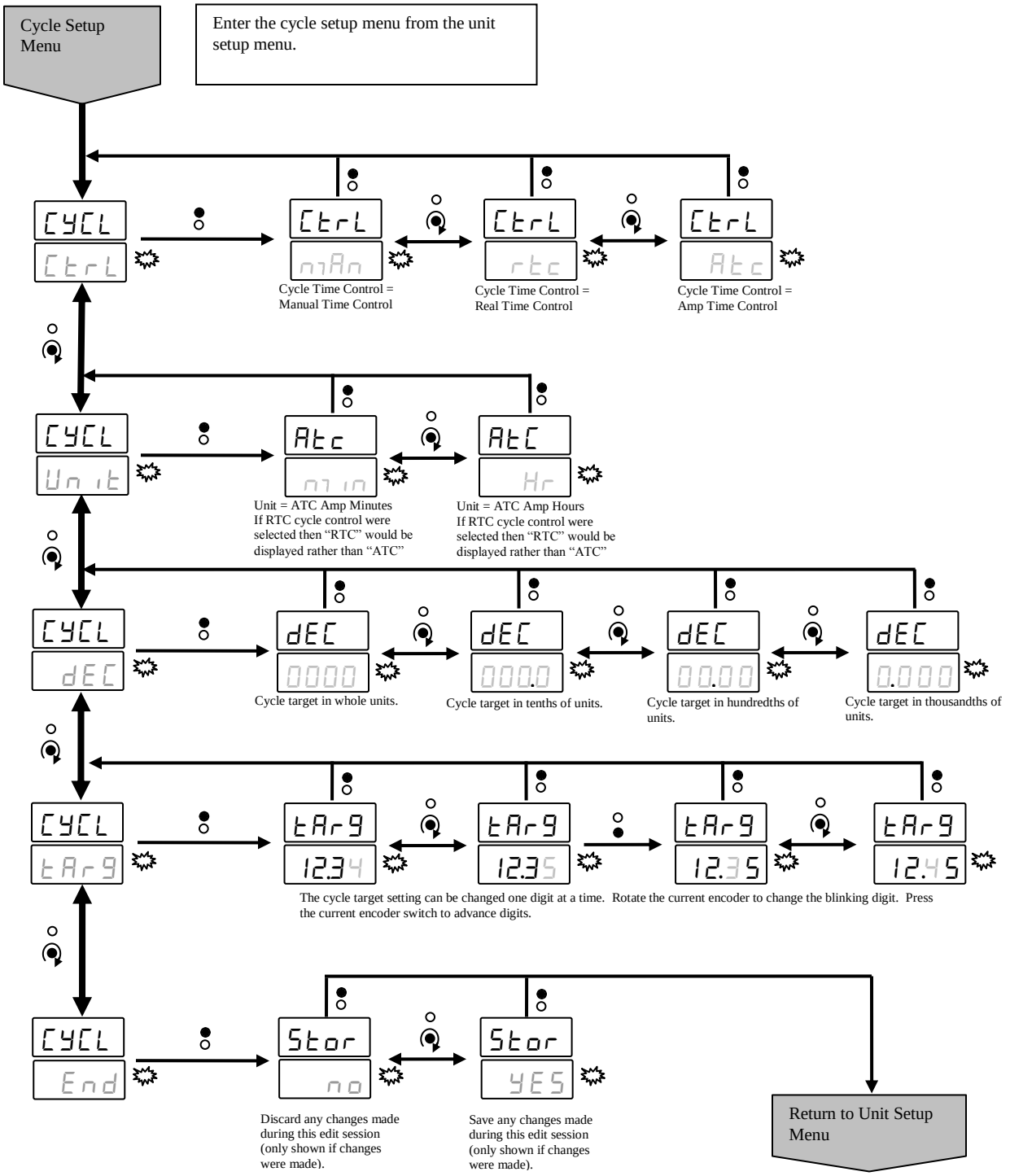
A.4 Display Select Menu


Enter the display select menu from any run screen (meters, totalizer, cycle, or diagnostics) by pressing and holding both encoder switches for one second.
Once "diSP" "SEL" is displayed release both encoder switches.
Meter Run Screen
Voltage and current meter run screen.
Pressing the voltage encoder displays the voltage setting and enables edit of the voltage setting. Rotate the voltage encoder to change digit values, press the voltage encoder to select digits.
Pressing the current encoder displays the current setting and enables edit of the current setting. Rotate the current encoder to change digit values, press the current encoder to select digits.
After the settings are not adjusted for a short period of time the display returns to the meter values.
Totalizer Run Screen
First screen showing total amp hours
Second screen showing total amp hours
Third screen showing total amp hours. If the units were amp minutes then this screen would show "min" rather than "Hr".
Last Screen, blinking 'Lo' to indicate the lower four digits of the total amp hours are displayed. Rotate the voltage encoder to change to 'Hi' and show the upper four digits.
Cycle Run Screen
First screen showing ATC amp hours remaining in the currently running cycle. If the currently running cycle were an RTC controlled cycle then "RTC" would be displayed rather than "ATC".
Second screen showing ATC amp hours remaining in the currenlyt running cycle.
Last screen showing ATC amp hours remaining in the currenlyt running cycle. If the units were amp minutes then this screen would show "min" rather than "Hr".
Pressing the current encoder displays the target ATC/RTC setting and allows direct edit of the target setting (standby only). After the setting is not changed for a short period of time the display returns to the cycle count down.
Diagnostic Run Screen
Heat sink temperature = 25C
Heat sink temperature = 77F
Fan speed = 55%

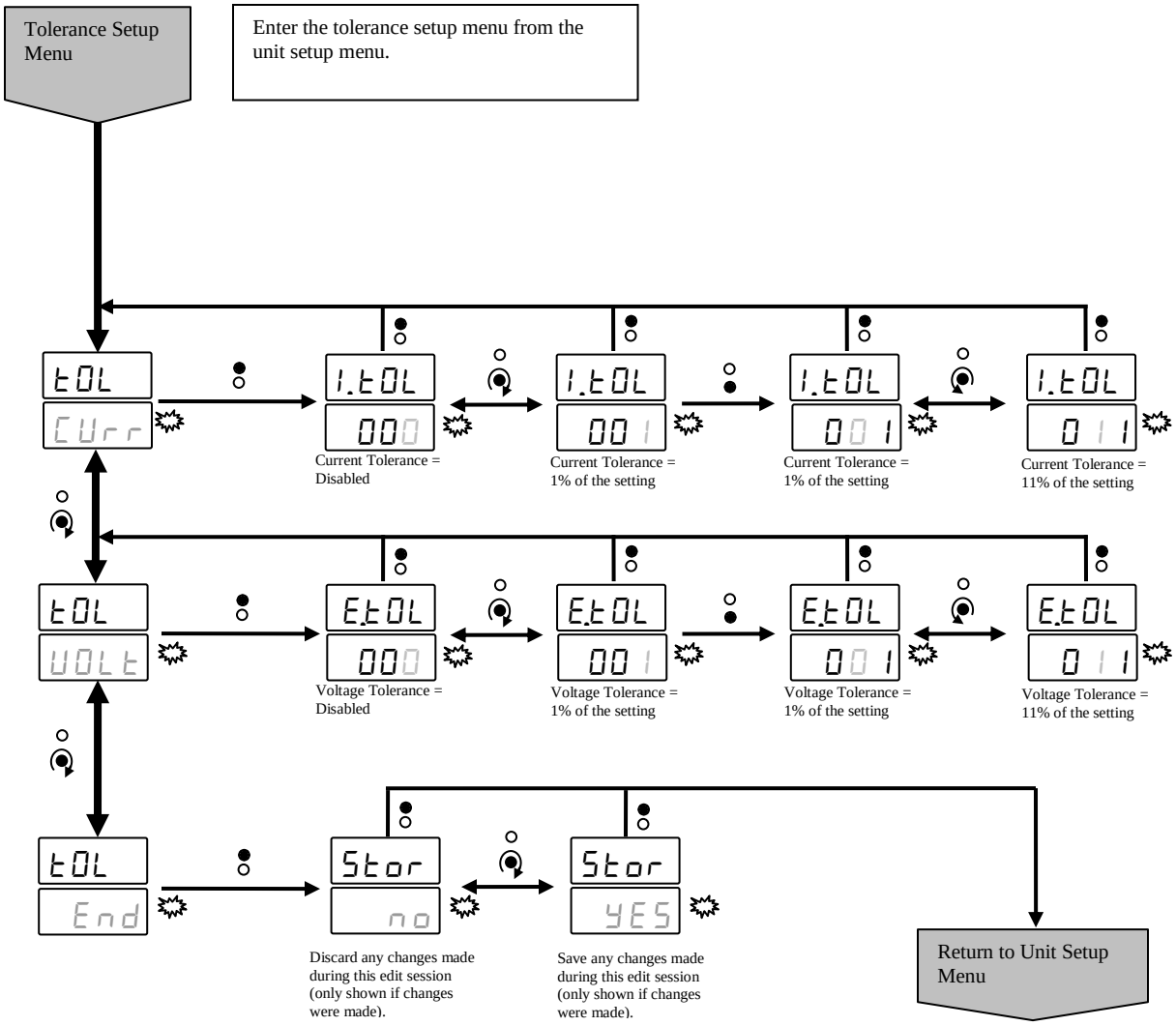
A.5 Unit Setup Menu



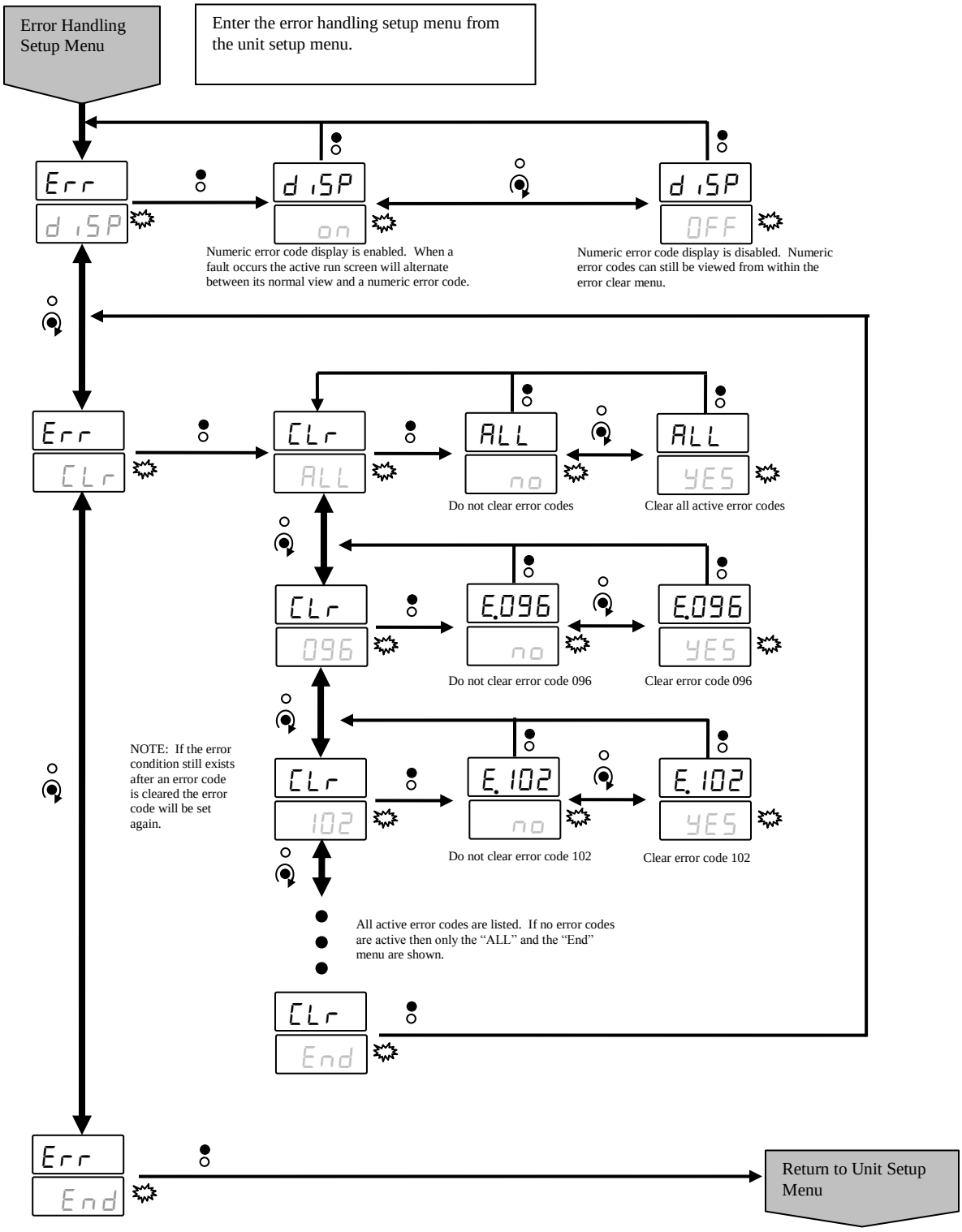
A.5.1 Cycle Setup Menu



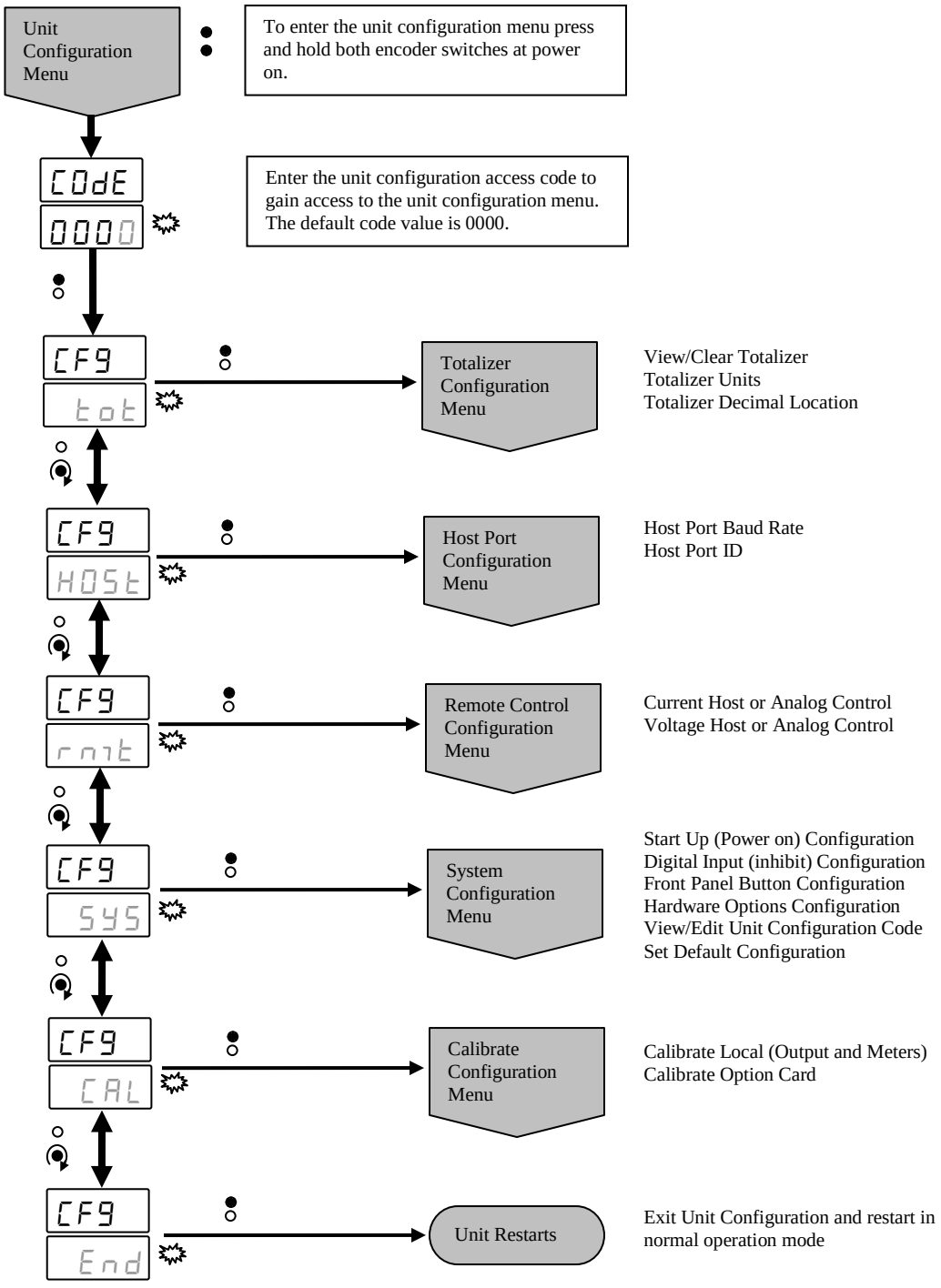
A.5.2 Tolerance Setup Menu



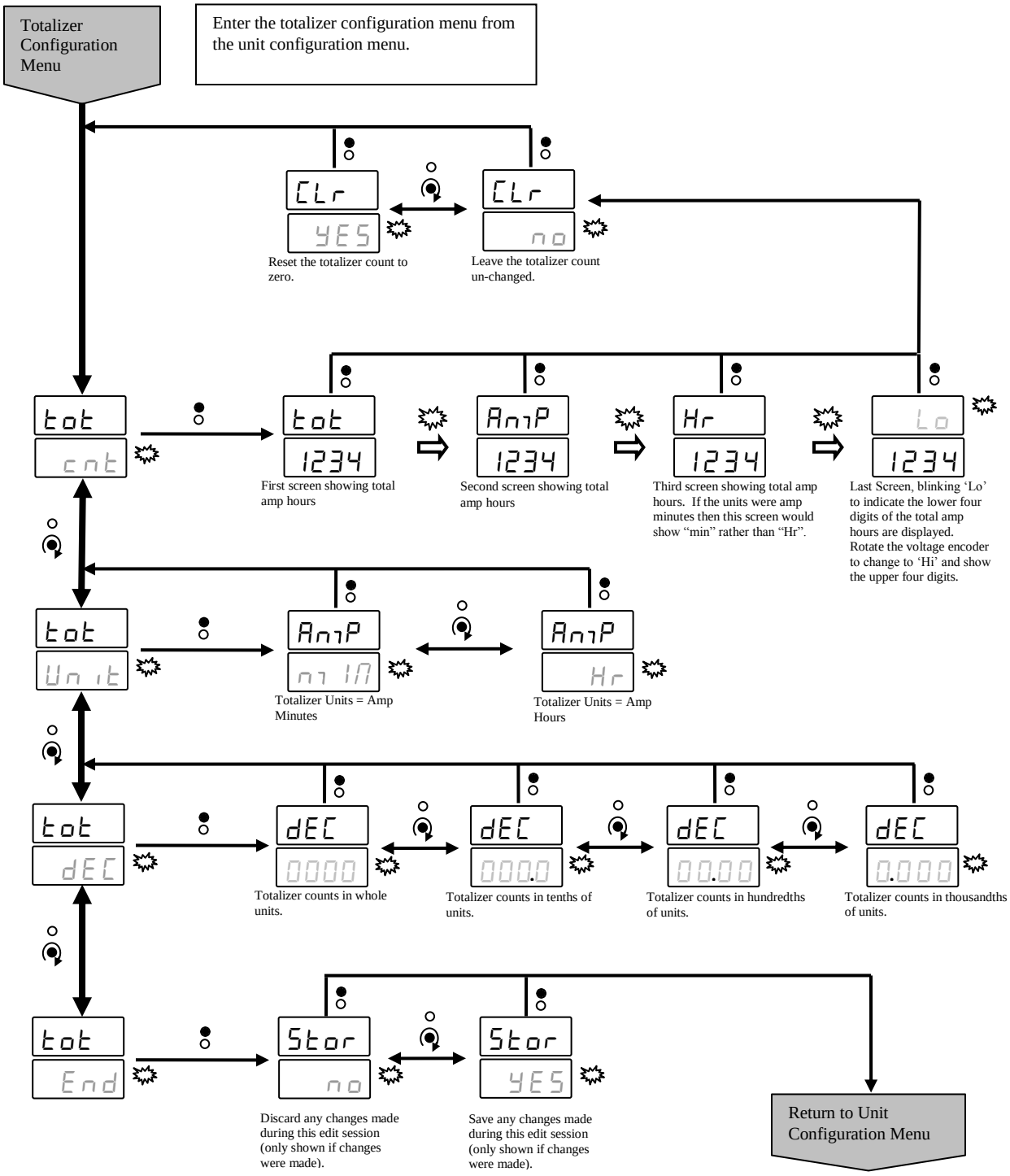
A.5.3 Error Handling Setup Menu



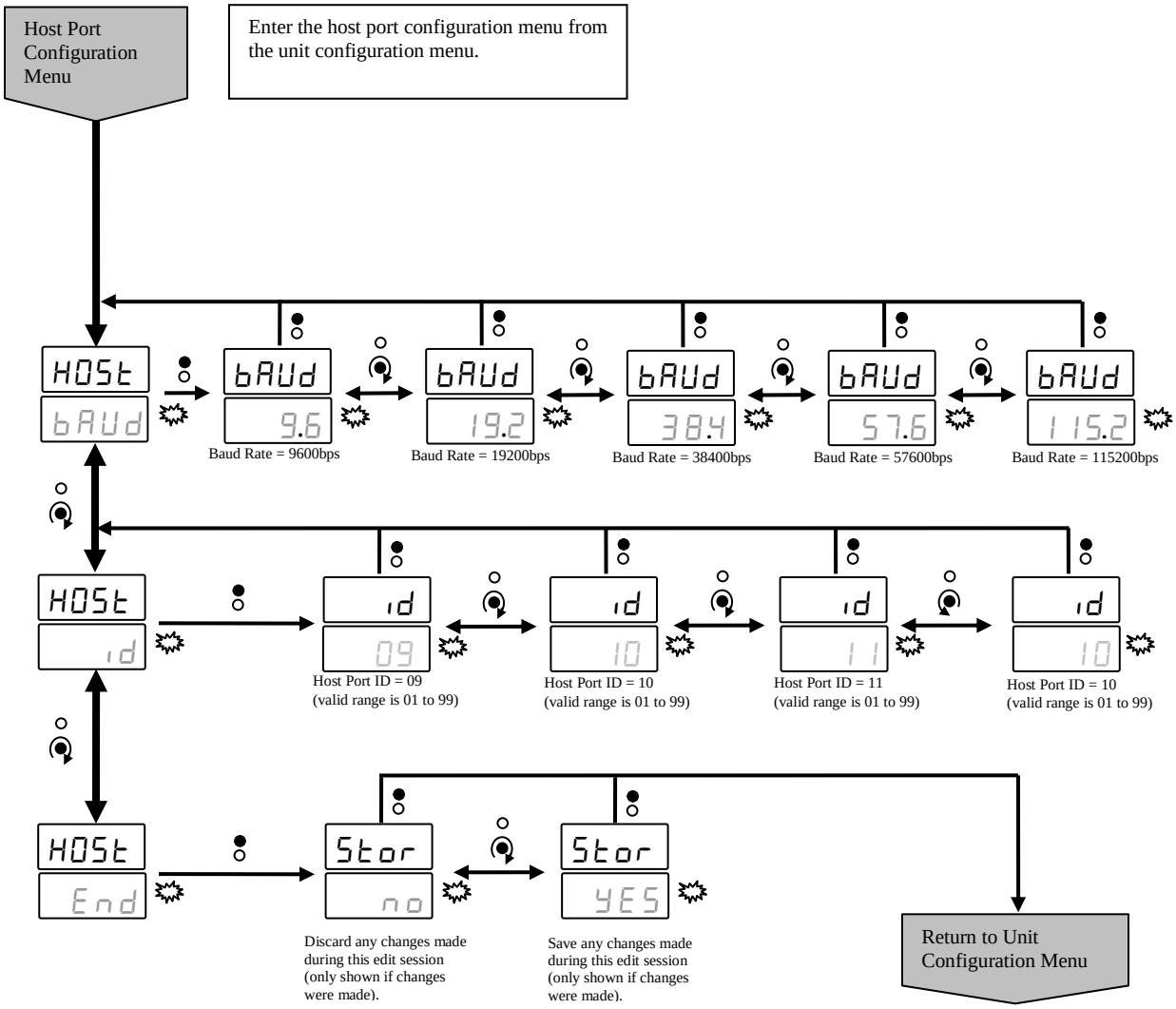
A.6 Unit Configuration Menu



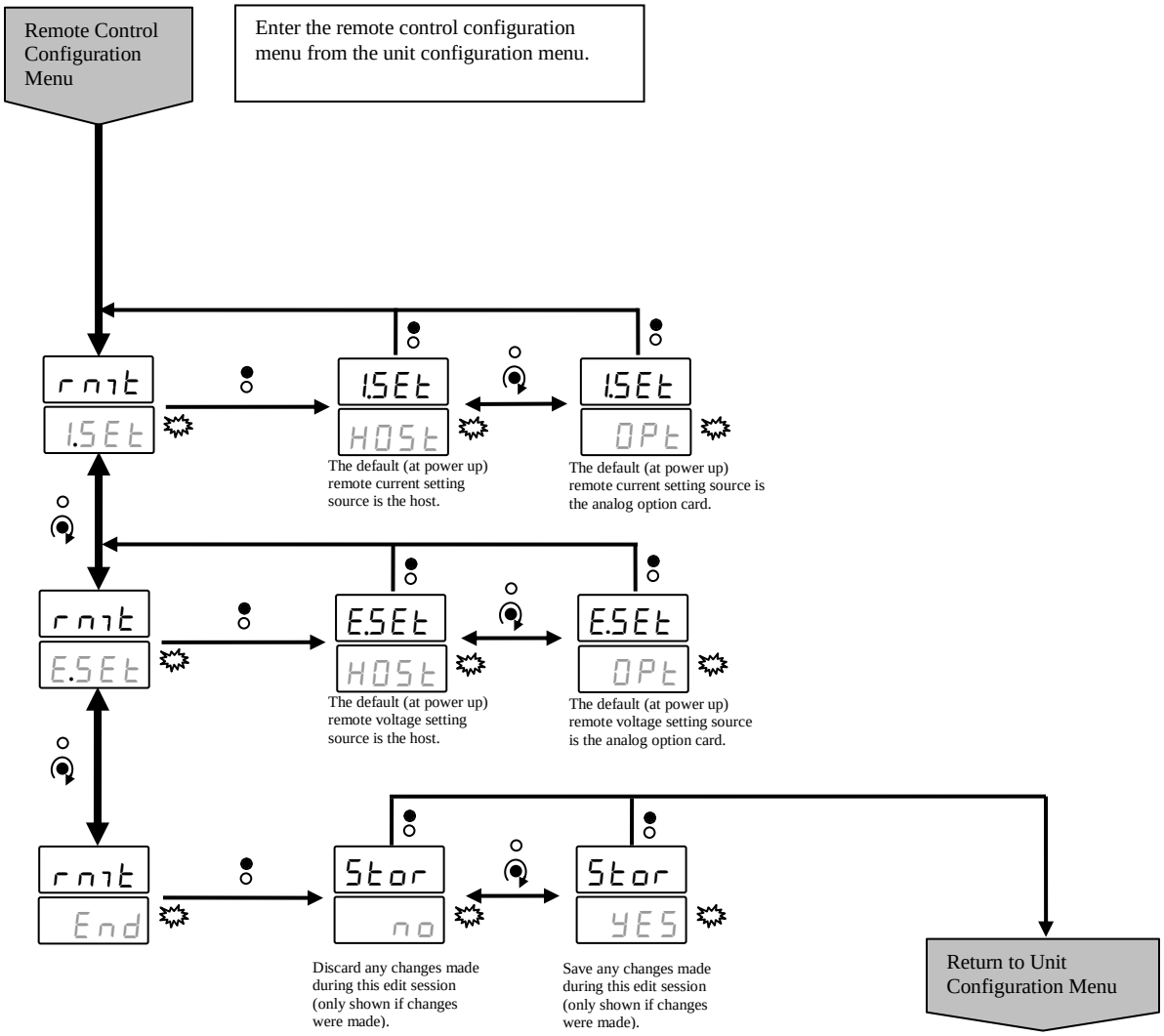
A.6.1 Totalizer Configuration Menu



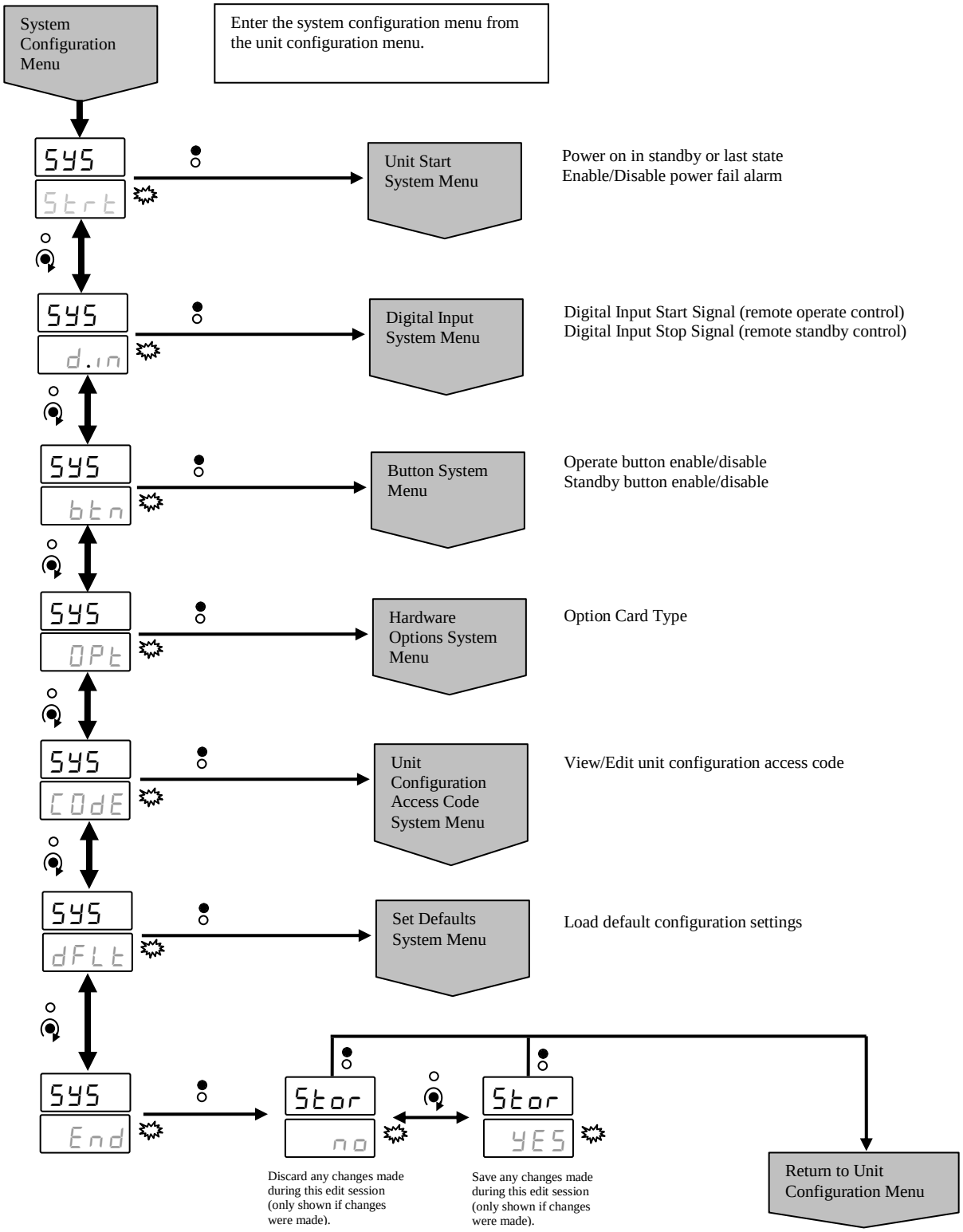
A.6.2 Host Port Configuration Menu



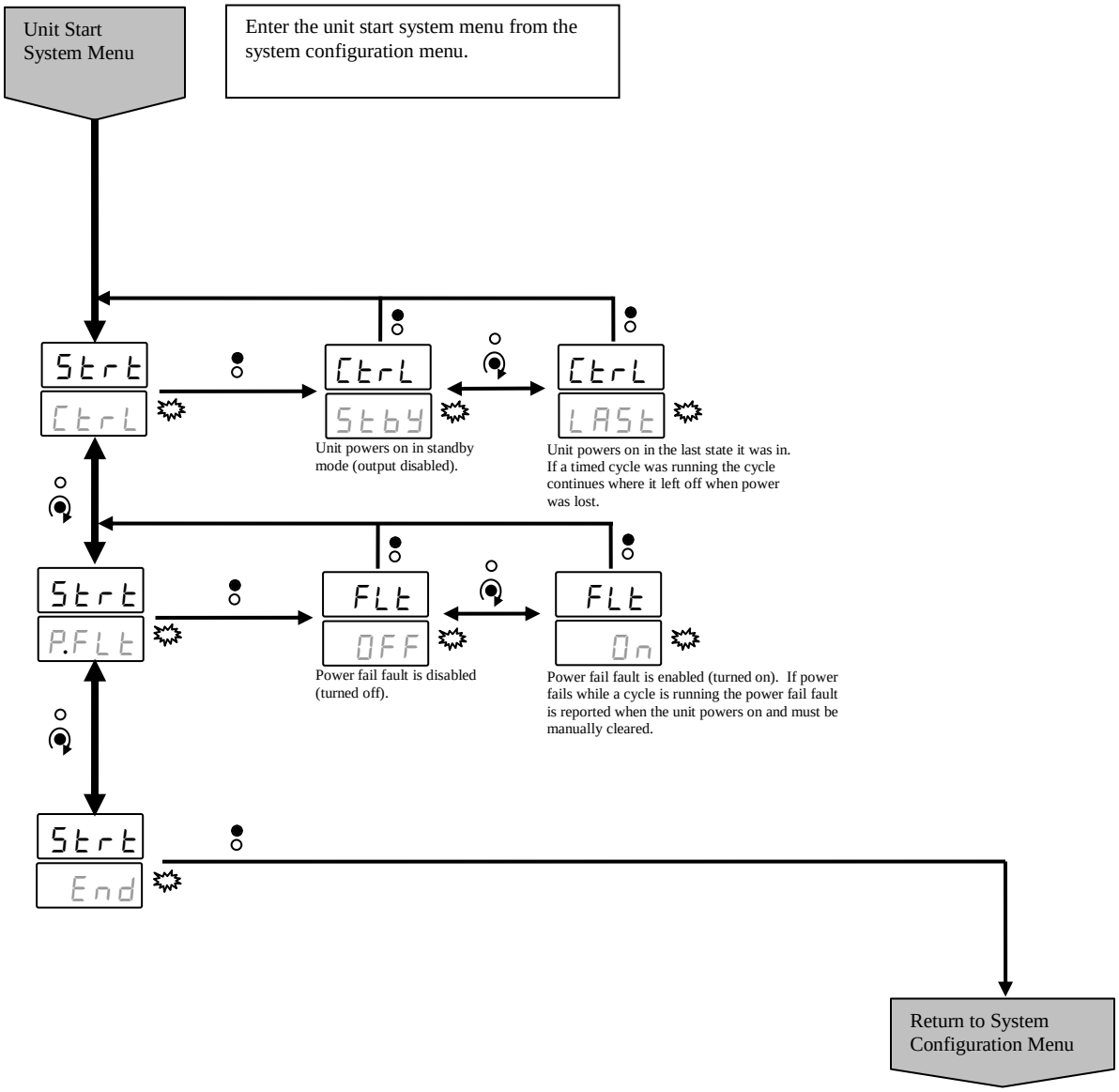
A.6.3 Remote Control Configuration Menu


Remote Control Configuration Menu
Enter the remote control configuration menu from the unit configuration menu.
rmt
I.SEt
I.SEt
HOSt
The default (at power up) remote current setting source is the host.
I.SEt
OPt
The default (at power up) remote current setting source is the analog option card.
rmt
E.SEt
E.SEt
HOSt
The default (at power up) remote voltage setting source is the host.
E.SEt
OPt
The default (at power up) remote voltage setting source is the analog option card.
rmt
End
Stor
no
Discard any changes made during this edit session (only shown if changes were made).
Stor
YES
Save any changes made during this edit session (only shown if changes were made).
Return to Unit Configuration Menu

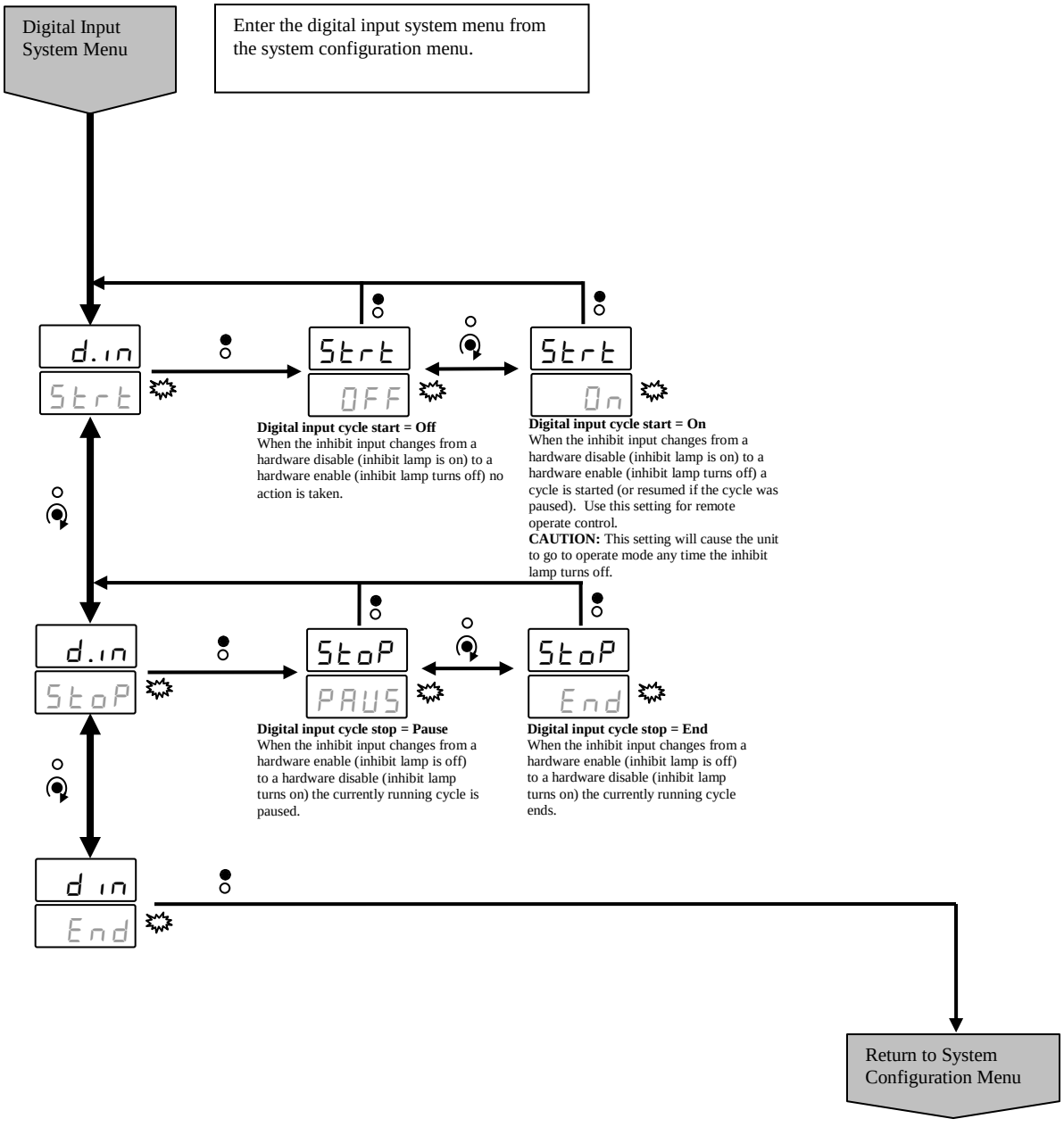
A.6.4 System Configuration Menu



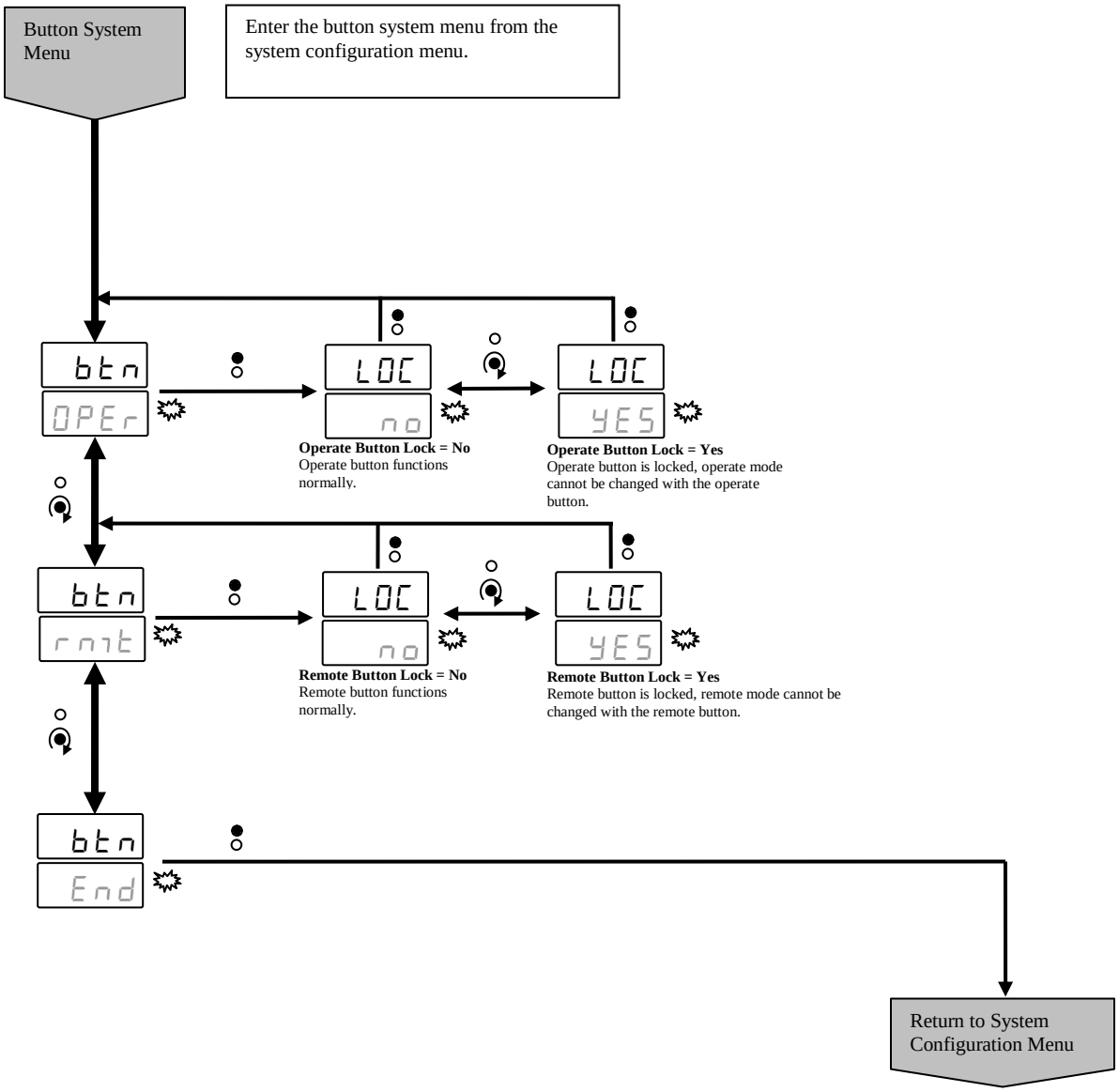
A.6.4.1 Unit Start System Menu


Unit Start System Menu
Enter the unit start system menu from the system configuration menu.
Strt
CtrL
CtrL
Stby
CtrL
LASt
Unit powers on in standby mode (output disabled).
Unit powers on in the last state it was in. If a timed cycle was running the cycle continues where it left off when power was lost.
Strt
P.FLt
FLt
OFF
FLt
On
Power fail fault is disabled (turned off).
Power fail fault is enabled (turned on). If power fails while a cycle is running the power fail fault is reported when the unit powers on and must be manually cleared.
Strt
End
Return to System Configuration Menu

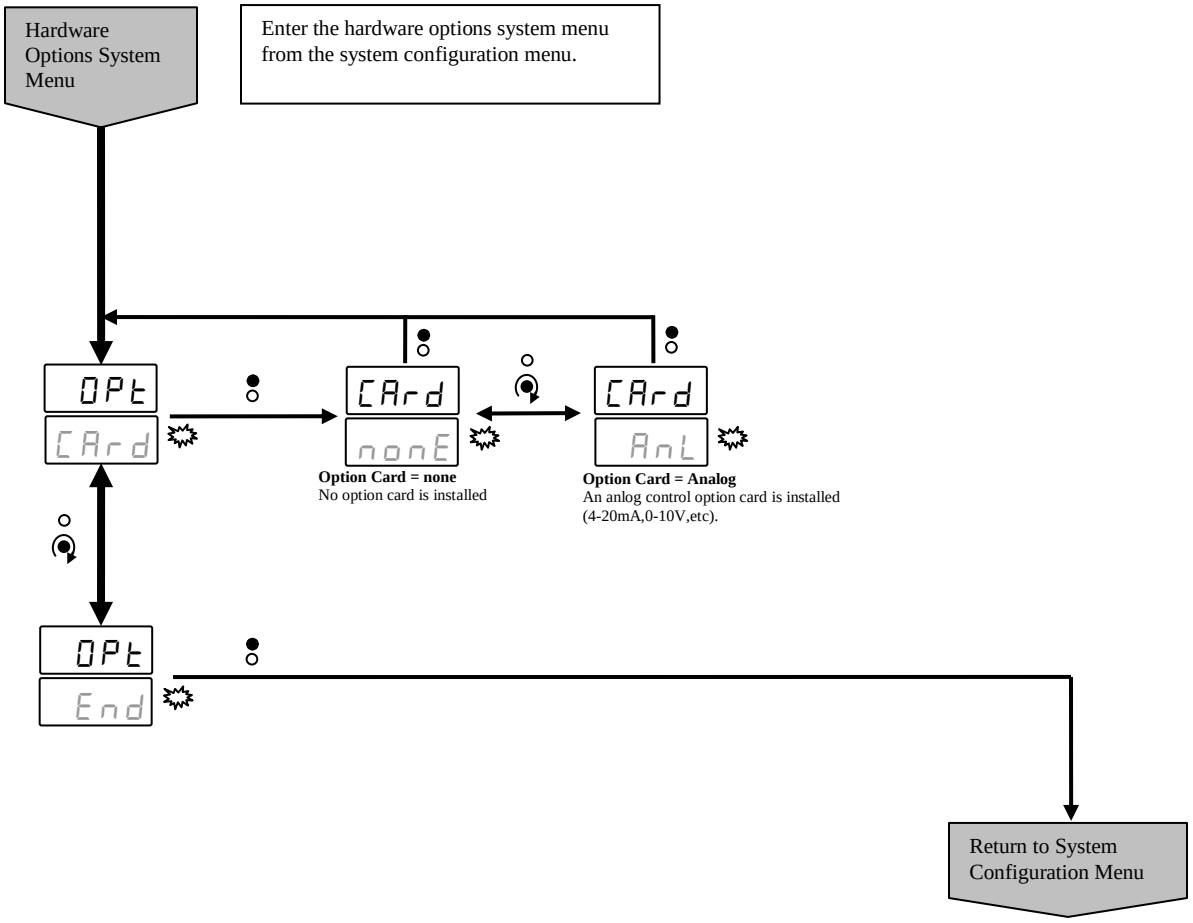
A.6.4.2 Digital Input System Menu


Digital Input System Menu
Enter the digital input system menu from the system configuration menu.
d.in
Strt
Strt
OFF
Strt
On
Digital input cycle start = Off
When the inhibit input changes from a hardware disable (inhibit lamp is on) to a hardware enable (inhibit lamp turns off) no action is taken.
Digital input cycle start = On
When the inhibit input changes from a hardware disable (inhibit lamp is on) to a hardware enable (inhibit lamp turns off) a cycle is started (or resumed if the cycle was paused). Use this setting for remote operate control.
CAUTION: This setting will cause the unit to go to operate mode any time the inhibit lamp turns off.
d.in
StoP
StoP
PAUS
StoP
End
Digital input cycle stop = Pause
When the inhibit input changes from a hardware enable (inhibit lamp is off) to a hardware disable (inhibit lamp turns on) the currently running cycle is paused.
Digital input cycle stop = End
When the inhibit input changes from a hardware enable (inhibit lamp is off) to a hardware disable (inhibit lamp turns on) the currently running cycle ends.
d in
End
Return to System Configuration Menu

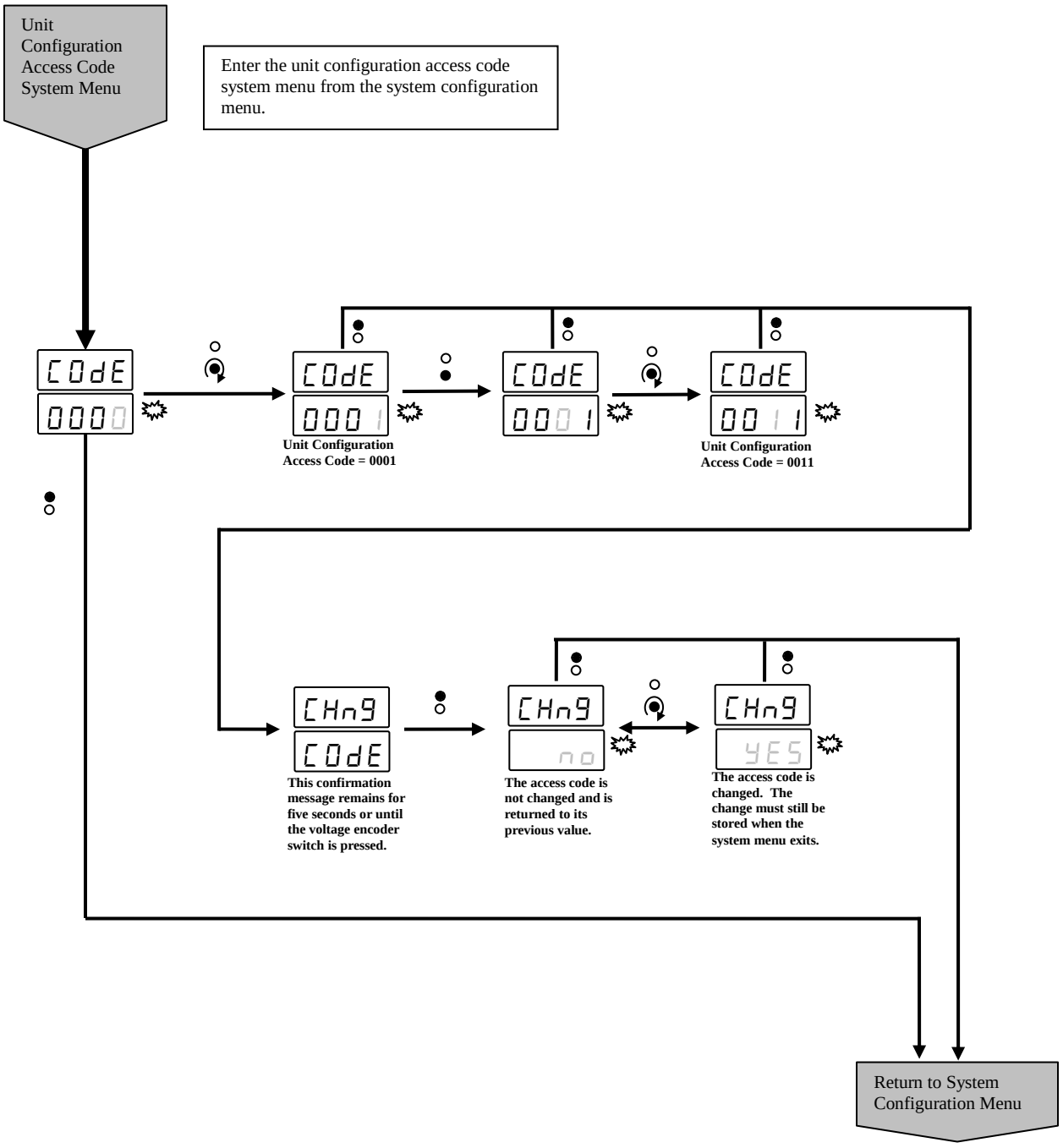
A.6.4.3 Button System Menu



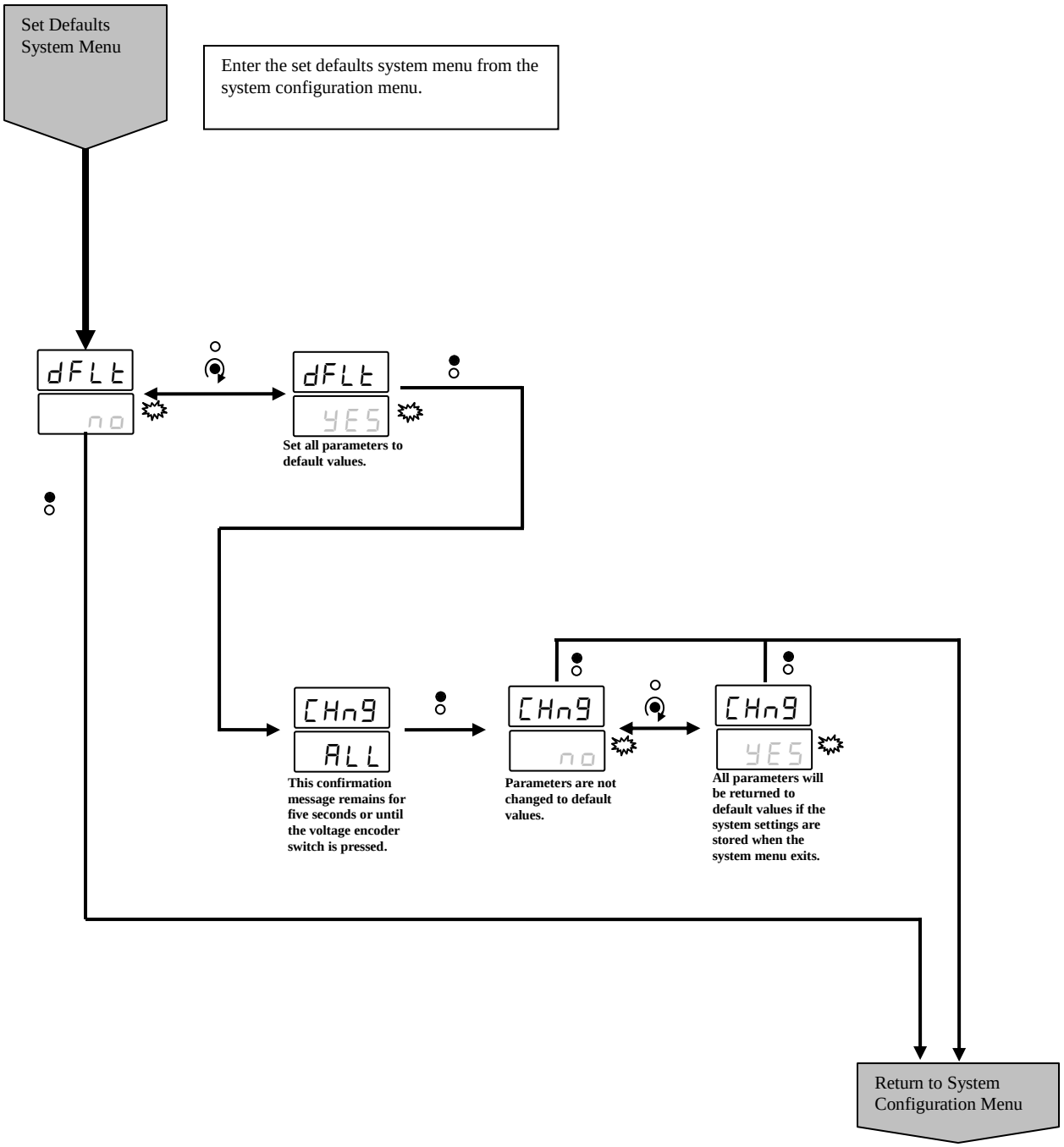
A.6.4.4 Hardware Options System Menu



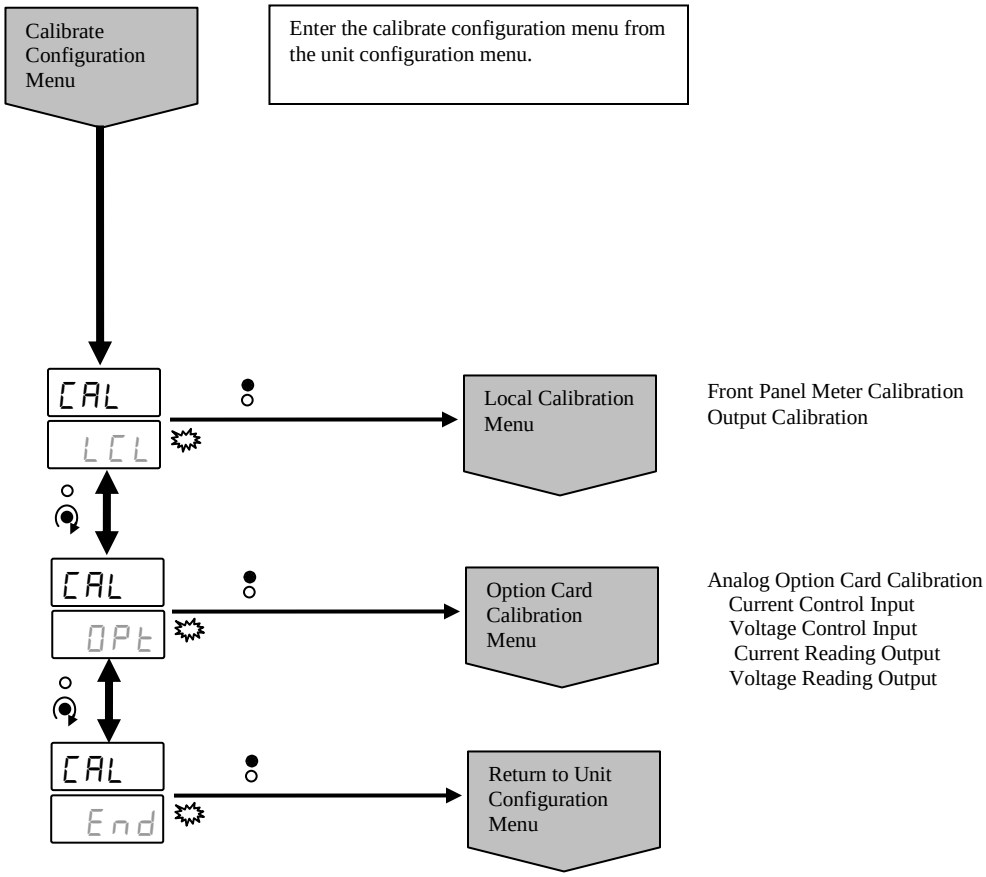
A.6.4.5 Unit Configuration Access Code System Menu


Unit Configuration Access Code System Menu
Enter the unit configuration access code system menu from the system configuration menu.
CODE
0000
CODE
0001
Unit Configuration Access Code = 0001
CODE
0001
CODE
0011
Unit Configuration Access Code = 0011
CHNG
CODE
This confirmation message remains for five seconds or until the voltage encoder switch is pressed.
CHNG
no
The access code is not changed and is returned to its previous value.
CHNG
YES
The access code is changed. The change must still be stored when the system menu exits.
Return to System Configuration Menu

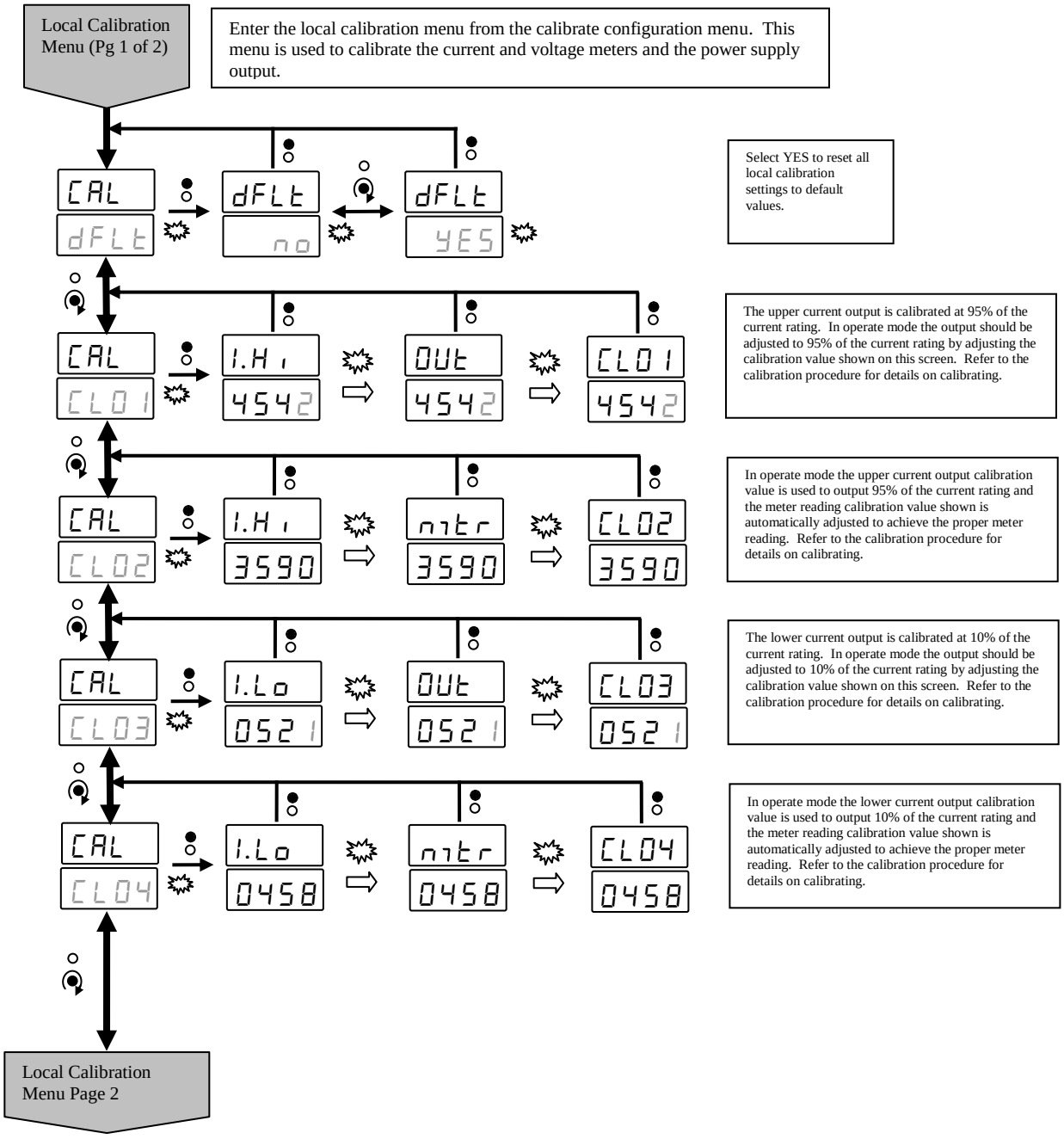
A.6.4.6 Set Defaults System Menu

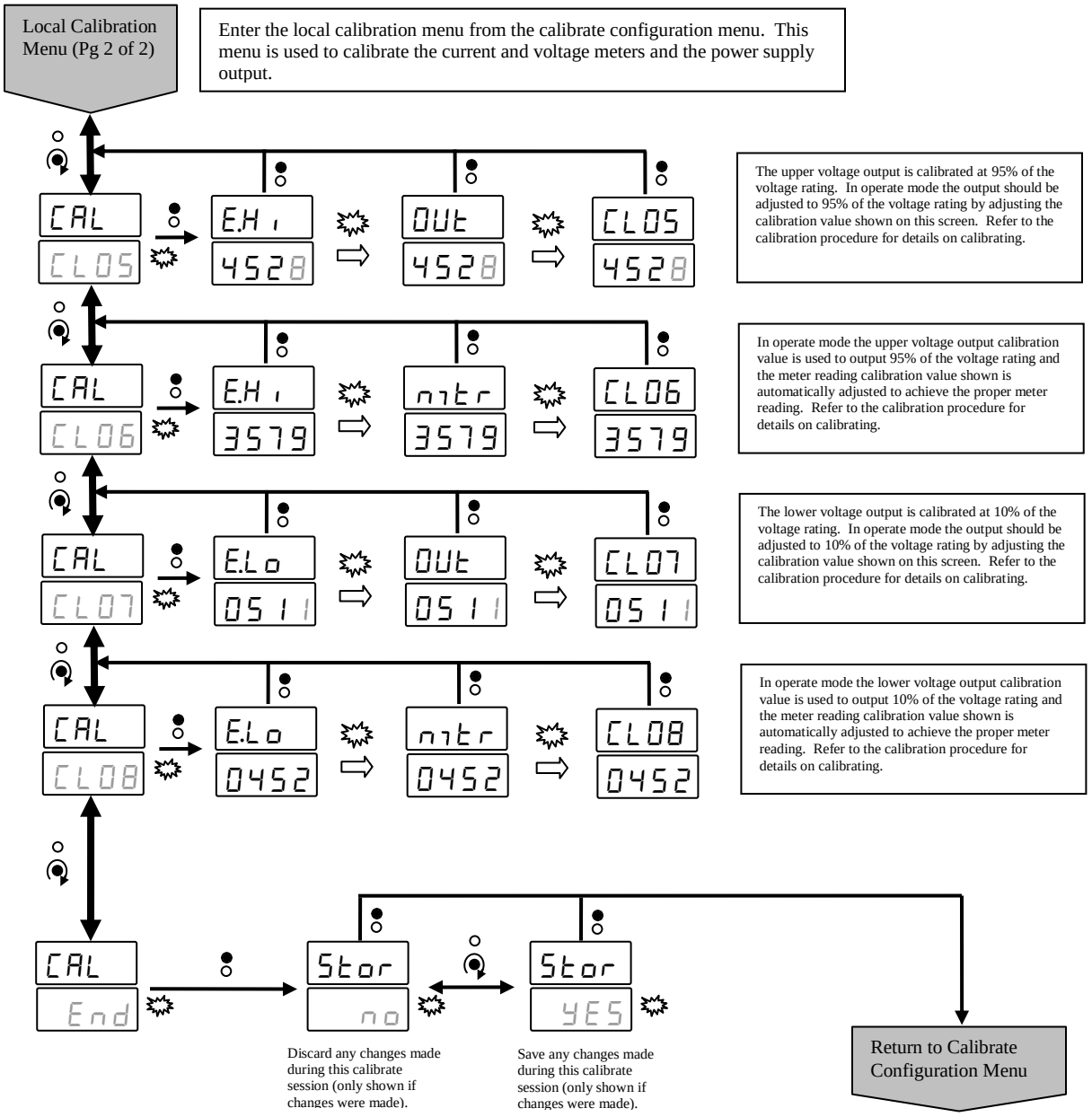

Set Defaults System Menu
Enter the set defaults system menu from the system configuration menu.
dFLt
no
dFLt
YES
Set all parameters to default values.
CHn9
ALL
This confirmation message remains for five seconds or until the voltage encoder switch is pressed.
CHn9
no
Parameters are not changed to default values.
CHn9
YES
All parameters will be returned to default values if the system settings are stored when the system menu exits.
Return to System Configuration Menu

A.6.5 Calibrate Configuration Menu

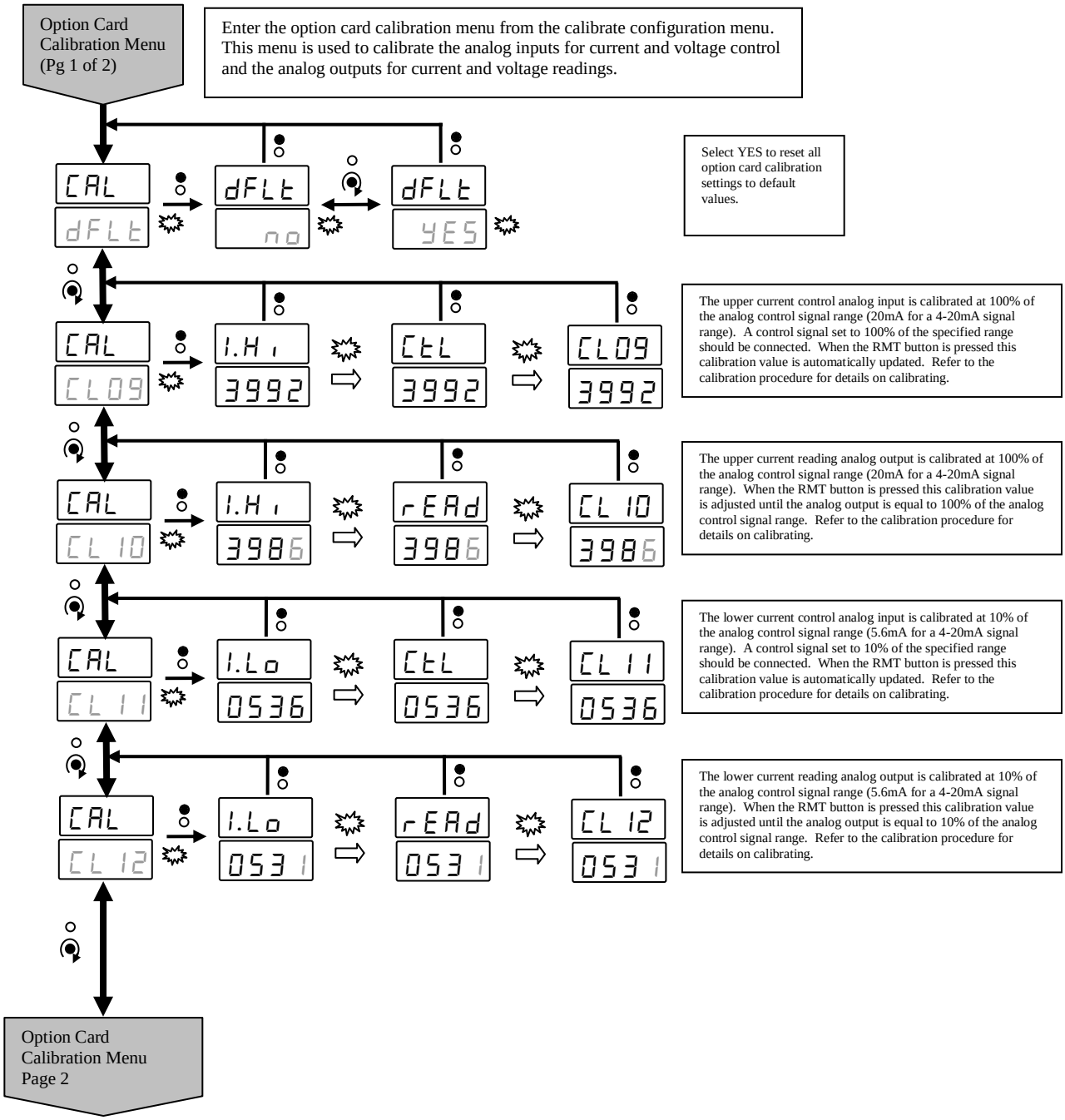


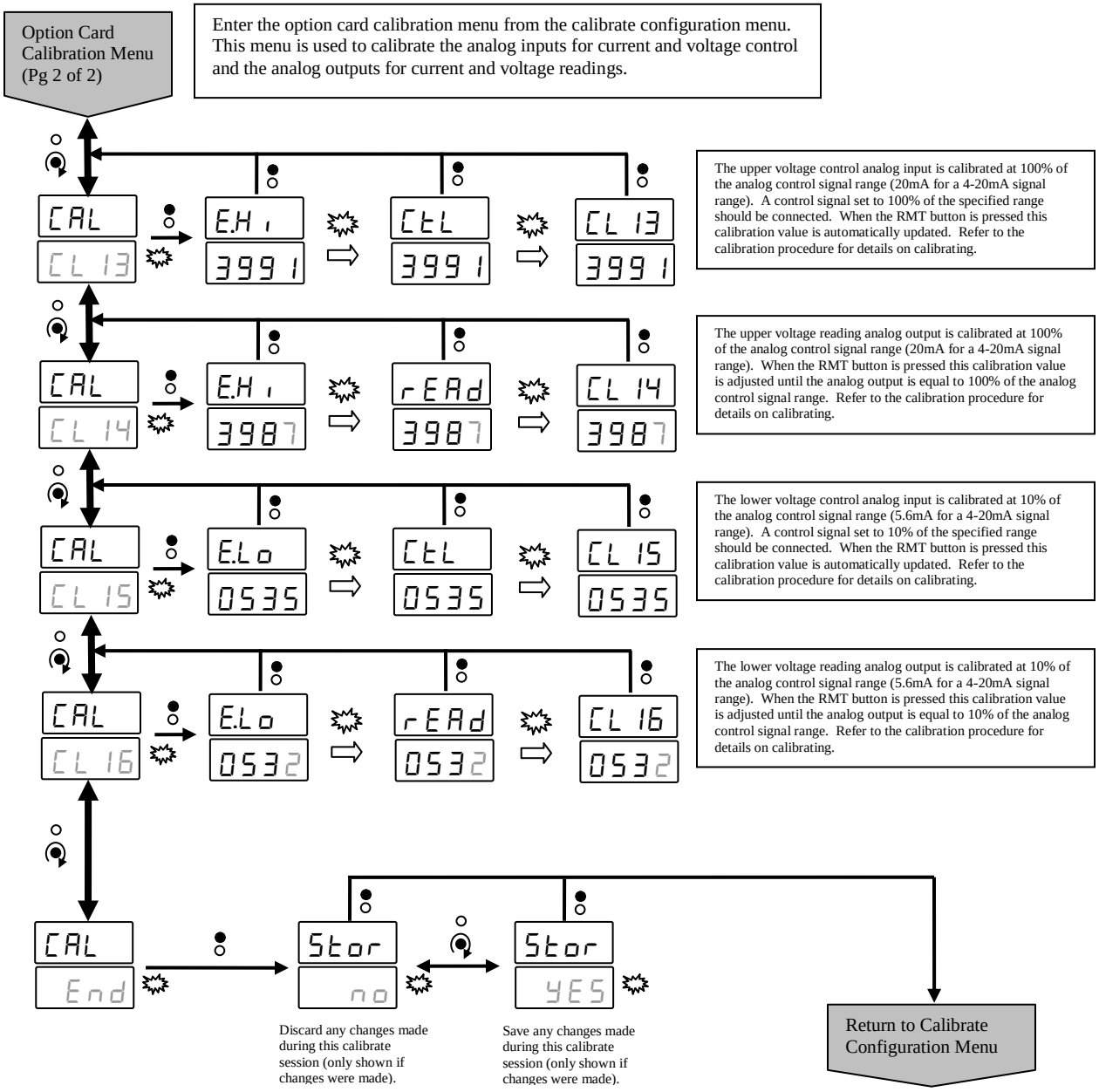
A.6.5.1 Local Calibration Menu


Local Calibration Menu (Pg 1 of 2)
Enter the local calibration menu from the calibrate configuration menu. This menu is used to calibrate the current and voltage meters and the power supply output.
CAL
dFLt
dFLt
no
dFLt
YES
Select YES to reset all local calibration settings to default values.
CAL
CL01
I.Hi
4542
OUt
4542
CL01
4542
The upper current output is calibrated at 95% of the current rating. In operate mode the output should be adjusted to 95% of the current rating by adjusting the calibration value shown on this screen. Refer to the calibration procedure for details on calibrating.
CAL
CL02
I.Hi
3590
mtr
3590
CL02
3590
In operate mode the upper current output calibration value is used to output 95% of the current rating and the meter reading calibration value shown is automatically adjusted to achieve the proper meter reading. Refer to the calibration procedure for details on calibrating.
CAL
CL03
I.Lo
0521
OUt
0521
CL03
0521
The lower current output is calibrated at 10% of the current rating. In operate mode the output should be adjusted to 10% of the current rating by adjusting the calibration value shown on this screen. Refer to the calibration procedure for details on calibrating.
CAL
CL04
I.Lo
0458
mtr
0458
CL04
0458
In operate mode the lower current output calibration value is used to output 10% of the current rating and the meter reading calibration value shown is automatically adjusted to achieve the proper meter reading. Refer to the calibration procedure for details on calibrating.
Local Calibration Menu Page 2


Local Calibration Menu (Pg 2 of 2)
Enter the local calibration menu from the calibrate configuration menu. This menu is used to calibrate the current and voltage meters and the power supply output.
CAL
CL05
E.Hi
4528
OUt
4528
CL05
4528
The upper voltage output is calibrated at 95% of the voltage rating. In operate mode the output should be adjusted to 95% of the voltage rating by adjusting the calibration value shown on this screen. Refer to the calibration procedure for details on calibrating.
CAL
CL06
E.Hi
3579
mtr
3579
CL06
3579
In operate mode the upper voltage output calibration value is used to output 95% of the voltage rating and the meter reading calibration value shown is automatically adjusted to achieve the proper meter reading. Refer to the calibration procedure for details on calibrating.
CAL
CL07
E.Lo
0511
OUt
0511
CL07
0511
The lower voltage output is calibrated at 10% of the voltage rating. In operate mode the output should be adjusted to 10% of the voltage rating by adjusting the calibration value shown on this screen. Refer to the calibration procedure for details on calibrating.
CAL
CL08
E.Lo
0452
mtr
0452
CL08
0452
In operate mode the lower voltage output calibration value is used to output 10% of the voltage rating and the meter reading calibration value shown is automatically adjusted to achieve the proper meter reading. Refer to the calibration procedure for details on calibrating.
CAL
End
Stor
no
Stor
YES
Discard any changes made during this calibrate session (only shown if changes were made).
Save any changes made during this calibrate session (only shown if changes were made).
Return to Calibrate Configuration Menu

A.6.5.2 Option Card Calibration Menu


Option Card Calibration Menu (Pg 1 of 2)
Enter the option card calibration menu from the calibrate configuration menu. This menu is used to calibrate the analog inputs for current and voltage control and the analog outputs for current and voltage readings.
CAL
dFLt
dFLt
no
dFLt
YES
Select YES to reset all option card calibration settings to default values.
CAL
CL09
I.Hi
3992
CtL
3992
CL09
3992
The upper current control analog input is calibrated at 100% of the analog control signal range (20mA for a 4-20mA signal range). A control signal set to 100% of the specified range should be connected. When the RMT button is pressed this calibration value is automatically updated. Refer to the calibration procedure for details on calibrating.
CAL
CL10
I.Hi
3986
rEAd
3986
CL10
3986
The upper current reading analog output is calibrated at 100% of the analog control signal range (20mA for a 4-20mA signal range). When the RMT button is pressed this calibration value is adjusted until the analog output is equal to 100% of the analog control signal range. Refer to the calibration procedure for details on calibrating.
CAL
CL11
I.Lo
0536
CtL
0536
CL11
0536
The lower current control analog input is calibrated at 10% of the analog control signal range (5.6mA for a 4-20mA signal range). A control signal set to 10% of the specified range should be connected. When the RMT button is pressed this calibration value is automatically updated. Refer to the calibration procedure for details on calibrating.
CAL
CL12
I.Lo
0531
rEAd
0531
CL12
0531
The lower current reading analog output is calibrated at 10% of the analog control signal range (5.6mA for a 4-20mA signal range). When the RMT button is pressed this calibration value is adjusted until the analog output is equal to 10% of the analog control signal range. Refer to the calibration procedure for details on calibrating.
Option Card Calibration Menu Page 2


Option Card Calibration Menu (Pg 2 of 2)
Enter the option card calibration menu from the calibrate configuration menu. This menu is used to calibrate the analog inputs for current and voltage control and the analog outputs for current and voltage readings.
CAL
CL 13
E.Hi
3991
CtL
3991
CL 13
3991
The upper voltage control analog input is calibrated at 100% of the analog control signal range (20mA for a 4-20mA signal range). A control signal set to 100% of the specified range should be connected. When the RMT button is pressed this calibration value is automatically updated. Refer to the calibration procedure for details on calibrating.
CAL
CL 14
E.Hi
3987
rEAd
3987
CL 14
3987
The upper voltage reading analog output is calibrated at 100% of the analog control signal range (20mA for a 4-20mA signal range). When the RMT button is pressed this calibration value is adjusted until the analog output is equal to 100% of the analog control signal range. Refer to the calibration procedure for details on calibrating.
CAL
CL 15
E.Lo
0535
CtL
0535
CL 15
0535
The lower voltage control analog input is calibrated at 10% of the analog control signal range (5.6mA for a 4-20mA signal range). A control signal set to 10% of the specified range should be connected. When the RMT button is pressed this calibration value is automatically updated. Refer to the calibration procedure for details on calibrating.
CAL
CL 16
E.Lo
0532
rEAd
0532
CL 16
0532
The lower voltage reading analog output is calibrated at 10% of the analog control signal range (5.6mA for a 4-20mA signal range). When the RMT button is pressed this calibration value is adjusted until the analog output is equal to 10% of the analog control signal range. Refer to the calibration procedure for details on calibrating.
CAL
End
Stor
no
Stor
YES
Discard any changes made during this calibrate session (only shown if changes were made).
Save any changes made during this calibrate session (only shown if changes were made).
Return to Calibrate Configuration Menu

Appendix B: Host Port Protocol

B.1.1 Host Protocol Version Information

Host Protocol Version	Firmware Versions
1.xx	All versions prior to v3.00 (200-1458-V300)
*2.00	V3.00 to V#.## (200-1458-V300 to 200-1458-V###)

* Protocol version defined in this document

B.1.2 Command List

Command Character	Description	Section
*	Slave responses, ACK or NAK, always return the same letter as command received by the slave from the host.	
a	State command	B.1.13
c	CRC Disable/Enable command	B.1.10
d	Readings command	B.1.14
h	Error History command	B.1.16
i	Delimiter Text Disable/Enable command	B.1.11
m	Error Status command	B.1.15
s	Setup command.	B.1.12
t	User Settings command	B.1.17
u	Unit info command	B.1.18

B.1.3 Command Format

Example Command: @00.0e3#2,NN.NNtext1,NNtext2,CRCcrlf

command field	field description for example above	delimiter text
@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0 for LT1200W Series)	
e3	Command character (e in this example) and Type – 0=read, 1=set, 2=activate, 3=ack, 4=nak	
#2,	Number of fields character (#) and number of fields (2) after the comma (2 in this example), excluding the CRC field	
NN.NN,	Command fields (values shown are just for example)	text1
NN,	Command fields (values shown are just for example)	text2
CRC	CRC value in ASCII decimal, (value shown as 54321 in examples), see **CRC Calculation** below. Calculate from all preceding chars including @ and the comma before the CRC. The CRC value can be 1 to 5 digits.	
crlf	Carriage return and Line feed (0x0D 0x0A)	

B.1.4 Formatting Rules

1. The protocol is a master/slave format where the LT controller is the slave and the device talking to the LT is the master or host. The master always initiates a command and then waits for a response from the slave.

2. ASCII based, no control characters (except CR-LF terminator), only standard alpha-numeric-punctuation characters.

3. Numbers are numeric only (decimal) and can have a decimal point (period)

4. The "@" is the sync character, any @ received in the middle of a command will cause a NAK error and restart the parser.

5. All data fields are delimited by at least a comma “,”

6. Delimiters can be alpha-numeric-punctuation (not period "." or "@") and require a comma "," at the end.

7. Delimiters can have any desired text, except as noted above, between the field number and the comma but cannot start with a numeric (0-9) value (ie. **S6LoopTo,** is a valid delimiter).

8. The slave response delimiter text is shown in the right most column in the command tables. This text is what the unit will return as a delimiter if enabled with the “i” command. Delimiter text is mainly used for troubleshooting as an easier way to manually decode fields. **There is no requirement for the host to send delimiter text if delimiter text is enabled. The**

host can send delimiter text always if desired whether or not delimiter text is enabled.

9. All command characters are small letters (easier to differentiate from numbers, ie. s5 vs S5).

10. Commands are variable length.

11. Commands have CRC for error checking at the end of the command. The CRC is calculated from all the ascii characters, starting with the sync and ending with the comma before the CRC value. See section B.1.7 for CRC calculation code.

12. Out of range or invalid values received by a slave returns a NAK. If a NAK is returned it does not indicate that none of the command was acted on, it only indicates where there was a problem detected. It is possible for part of a command to be processed and acted on even though one data field was determined to be invalid and a NAK is returned. The NAK message indicates where the first error was detected. If an ACK is returned then all portions of the command were determined to be valid and were processed. See the NAK command, section B.1.9.

13. A NAK response is not returned by a slave if the CRC is enabled and the slave determines that the CRC was incorrect.

14. Commands are terminated by carriage return 0x0D and line feed 0x0A

15. Any chars between a CR-LF and @ are ignored.

16. This protocol is fully text-editor compatible.

17. No scientific notation allowed (i.e. 7.65e2 or 4.56E-1 are not allowed).

18. No signed numbers allowed, sign is inferred as: forward values are positive, reverse values are negative, other values are positive (i.e. -2.54 or +3.75 are not allowed).

19. The 'no response' time-out duration the host uses should not be less than 10ms in order for the LT controller to have enough time to process commands.

20. The maximum length of any message (including text deliminters) should not exceed 1024 characters. Messages longer than 1024 bytes will result in a NAK response from the slave.

21. Slaves will not send a response to messages directed to the global address (device address 00). All slaves on the network will perform the requested action if they properly receive the command, however no response is sent

B.1.5 Unit Addressing (@AA.a)

Unit ID 'AA'	Channel ID 'a'	Description
00	0	Directed to all units
01	0	Directed to unit 1
99	0	Directed to unit 99

- For single channel supplies (LT1200W Series) set the channel ID to zero.
- No response is sent to commands directed to the global unit ID (00).

B.1.6 Communications Settings (factory default) – RS485

Baud Rate	Bits	Parity	Stop Bits	Handshake
*9600	8	none	1	none (master-slave)

- The RS485 host port can be operated on a multi-drop bus (multiple power supplies connected to a single host, all using the same communications cable). The master is always listening unless sending a command. Slave units are always listening for commands unless sending a response. Slave units only respond to commands that contain their address.

  * The baud rate is selectable, see the “User Settings” (t) command or Section B.1.17User Settings Command “t”: for setting the baud rate manually.

B.1.7 CRC Calculation

The CRC is used for error detection. The following is C code for the CRC calculation.

```
////////////////////////////////////////////////////////////////////////////
// FUNCTION:    CRC_Calc()
// DESCRIPTION: Calculate the CRC value for a string.
// PARAMETERS:  Pointer to the string to perform the CRC calculation on.
// RETURNS:     CRC word, 00000 to 65535.
// NOTES:       The CRC calculation used by all Dynatronix units.
////////////////////////////////////////////////////////////////////////////
uint16_t CRC_Calc (char * szData)
{
   uint16_t   uiCRC = 0xFFFF;
   int16_t    iCount = (int16_t)strlen(szData);
   int16_t    iIndex;
   char       cShiftCnt;

   for(iIndex = 0; iIndex < iCount; iIndex ++)
   {
      cShiftCnt = 8;
      uiCRC = (uint16_t)(uiCRC ^ (szData[iIndex] & 0xFF));
      while (cShiftCnt != 0)
      {
         if ((uiCRC & 0x0001) == 0x0001)
         {
            uiCRC = (uint16_t)((uiCRC >> 1) ^ (uint16_t)0xA001);
         }
         else
         {
            uiCRC = (uint16_t)(uiCRC >> 1);
         }
         cShiftCnt--;
      }
   }
   return uiCRC;

} //CRC_Calc
```

B.1.8 ACK Response Command

– Sent if no data requested, otherwise the data to be sent is the ACK

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0)	
s3	Command character of command received and Command Type – 3=ack	
#0,	Number of fields character and number of fields after the comma, excluding CRC	
CRC	CRC value in ascii decimal	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Example of ACK Command:

- ACK command for set setup command with no data to return from unit 24

  @24.0s3#0,54321

Notes:

1. When a slave sends an ACK command it is an indication that the command was determined to be valid and all data fields were determined to be valid and processed.
2. The slave does not send an ACK if the command was directed to the global unit address (00).

B.1.9 NAK Response Command

– Sent when an error occurs in parsing a command

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0)	
s4	Command character of command received and Command Type – 4=nak	
#10,	Number of fields character and number of fields after the comma, excluding CRC	
0,	undefined	na
0,	wrong number of fields – blank or 0=ok, 1=error	flds
0,	parse error, @ where none should be – blank or 0=ok, 1=error	pars
0,	unknown command – blank or 0=ok, 1=unknown cmd.	unkn
0,	bad field number – first field to be found bad – blank or 0=ok, 1-XX=field number	bfn
0,	undefined	bfv
0,	option not installed error – blank or 0=ok, 1=error	oni
0,	cannot operate – blank or 0=ok, 1=error	opr
0,	edit protect flag is enabled – blank or 0=ok, 1=protected	editf
0,	general NAK code (see possible values below)	gnc
	1 = Remote mode is required for the specified command	
	2 = Data out of range (bad field number indicates which field)	
	3 = Format error (bad field number indicates which field)	
	4 = Unknown command type (valid command types are set, read, ack, nak, etc)	
	5 = ‘Set’ command type not allowed for the specifed command	
	6 = Factory config mode is required for the specified command	
	7 = Rx buffer overrun (message was greater than 1024 charcters)	
	8 = Failed to perform the requested save	
	9 = ‘Set’ command type not allowed while in operate mode	
CRC	CRC value in ascii decimal	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Example of NAK Command:

- NAK’d setup command from unit 10 with a formatting error in field 2.

  @10.0s4#10,0na,0flds,0pars,0unkn,2bfn,0bfv,0oni,0opr,0editf,3gnc,54321

- NAK'd setup command, same as above with text delimiters disabled

  @10.0s4#10,0,0,0,0,2,0,0,0,0,3,54321

Notes:

1. Host does not send a NAK if it gets a bad response. Host should flag it as a communications error or firmware version issue.
2. The NAK indicates the location of the first problem detected. It is possible for the slave to process part of a message properly and still return a NAK for one or more invalid data fields. For example, it would be possible for a slave to receive a setup command and process the current setting but not the voltage setting if the voltage setting were out of range or improperly formatted. In this case the slave would return a NAK message indicating the first field with a problem.
3. The bad field number indicates which field was determined to be a problem. Fields are separated by commas. Field number 1 is the header. In the message "@01.1a1#2,1,0,12345" field number 3 has a value of '0'
4. The slave does not sent a NAK if the command was directed to the global unit address (00).
5. The slave does not send a NAK if it is unable to decode the unit address from the message.
6. The slave does not send a NAK if the CRC is enabled and the transmitted CRC does not match the slave calculated CRC for the message.

B.1.10 CRC Disable/Enable Command "c"

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0)	
c1	Command character and Type – 0=read, 1=set, 2=activate(n/a), 3=ack, 4=nak	
#1,	Number of fields character and number of fields after the comma, excluding CRC	
0,	CRC flag – 0=disable, 1=enable. Default on power supply power-up is Enabled.	crcf
CRC	CRC value in ascii decimal. NOTE: examples show actual CRC values.	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Example of CRC Enable/Disable Command:

- Disable CRC command

  @00.0c1#1,0,32516

- Enable CRC command

  @00.0c1#1,1,61189

- Read CRC state command.

  @12.0c0#0,25165

- ACK response for Read CRC State command from unit with address = 12, with CRC enabled. Shown with and without the delimiter text enabled.

  @12.0c3#1,1crcf,58566

  @12.0c3#1,1,15265

Notes:

1. Default CRC setting on power supply power-up is **Enabled**.
2. The channel ID 'a' should always be zero.

B.1.11 Delimiter Text Disable/Enable Command "i"

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0)	
i0	Command character and Type – 0=read, 1=set, 2=activate(n/a), 3=ack, 4=nak	
#1,	Number of fields character and number of fields after the comma, excluding CRC	
0,	Delimiter text flag – 0=disable, 1=enable. Default on power-up is disabled.	txtf
CRC	CRC value in ascii decimal. NOTE: examples show actual CRC values.	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Example of Delimiter Text Enable/Disable Command:

- Disable delimiter text command

  @00.0i1#1,0,54321

- Enable delimiter text command

  @00.0i1#1,1,54321

- Read delimiter text State command.

  @12.0i0#0,54321

- ACK response for read delimiter text state command, unit address = 12. Shown with delimiter text enabled and disabled.

  @12.0i3#1,1txf,54321

  @12.0i3#1,1,54321

Notes:

1. Delimiter Text setting on power supply power-up is **Disabled**.
2. There is no requirement for the host to send delimiter text if delimiter text is enabled, it is optional.
3. The channel ID 'a' should always be zero.

B.1.12 Setup Command “s”:

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (0 to 2; 0 is a global channel)	
s0	Command character and Type – 0=read, 1=set, 2=activate (n/a), 3=ack, 4=nak	
#12,	Number of fields character and number of fields after the comma, excluding CRC.	
100.0,	Forward Current Setting – amps	fi
12.25,	Forward Voltage settting – volts	fv
0,	Source of Current Setting in remote mode (0 = host, 1 = option card, 2 = standard analog input (not implemented)) (DC operation, home link = 0)	isrc
0,	Source of Voltage Setting in remote mode (0 = host, 1 = option card, 2 = standard analog input (not implemented)) (DC operation, home link = 0)	vsrc
0,	Current Tolerance - Percent of Setting (0 to 100, 0 = disable tolerance checks)	it
0,	Voltage Tolerance – Percent of Setting (0 to 100, 0 = disable tolerance checks)	vt
2,	XTC Control (0 = manual, 1 = RTC, 2 = ATC)	xc
1,	XTC Units (0=reserved, 1=ATC Amp Min, 2=ATC Amp Hr, 3=reserved, 4=RTC Min, 5=RTC Hr)	xn
2,	XTC Resolution (0=xxxx, 1=xxx.x, 2=xx.xx, 3=x.xxx)	xr
2450,	XTC Preset (0 to 9999, units and resolution are dependent on the xtc units and xtc resolution specified in this command)	xs
2,	Totalizer Units (0=reserved, 1=Amp Min, 2= Amp Hr)	tu
1,	Totalizer Resolution (0=xxxx, 1=xxx.x, 2=xx.xx, 3=x.xxx)	tr
CRC	CRC value in ascii decimal	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Examples of Setup Command

- Read setup command using device address 1, channel 1
  @01.1s0#0,54321

- Acknowledge read setup command
  @01.0s3#12,47.5fi,24.00fv,2isrc,2vsrc,0it,0vt,2xc,1xn,2xr,10.25xs,1tu,0tr,54321

- Use the setup command to enable the option card analog inputs to be used for adjusting the settings when the supply is in remote mode. Note that the current and voltage setting fields must be blank when changing the source of settings in remote mode if the source is not the host port.
  @01.1s1#4,,,1,1,54321
- Use the setup command to change the channel 1 current and voltage settings. In this example the source of the current setting and the source of the voltage setting will be forced to "host" because the host has just changed the settings (if the unit is not in remote mode the setup command will not be accepted and a NAK response will be sent).
  @01.1s1#2,25.5,11.75,54321

Notes:

1. Blank fields are ignored so whatever setting is currently active for that field will still be active after a command with a blank field.
2. A command type of 1 (set) is only allowed if the power supply is in remote mode as indicated by the LED on the front panel.
3. The source of the setting automatically changes to "host" if the setting value is changed by the host. For example, if the host changes the voltage setting using the setup command, then the source of the voltage setting is automatically changed to "host".
4. The "source of the settings in remote mode" setting has no effect when the supply is not in remote mode (remote mode is indicated when the RMT indicator is on).
5. The source of a setting can only be changed to "option card" if the appropriate option card is installed.
6. The voltage and current settings should be blank in any command where the source is set to a value other than the host.
7. The source of a setting in remote mode is the existing source of the setting in remote mode. Changing the source of a setting with this command will immediately change the source of the setting in remote mode. Changes made to the source of a setting in remote mode with this command will not be maintained through a power cycle. Use the user settings 't' command to change the default (at power on) source of the setting.
8. The operate and remote switch functionality when in the remote mode will depend on the settings in the User Settings command.
9. Sending this command with a command type of 0 (read) and the channel ID set to zero will receive no response. The channel must be specified (not zero) when reading settings with this command.
10. Both channels on a power supply can be set (command type 1) to the same value using one instance of this command with the channel set to zero.
11. Setting a XTC unit type that is not compatible with the currently selected XTC control type will cause a NAK response.
12. Changing the totalizer units or resolution will cause the totalizer value to be reset to zero. The totalizer can also be cleared using the user settings "t" command.

B.1.13 State Command “a”:

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0)	
a0	Command character and Type – 0=read, 1=set, 2=activate (n/a), 3=ack, 4=nak	
#2,	Number of fields character and number of fields after the comma, excluding CRC	
1,	operate state – 0=standby, 1=operate, 2 = pause	opr
0,	Simulation state – 0 = normal operation, 1 = simulation mode	sim
CRC	CRC value in ascii decimal	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Examples of State Command:

- read state from unit 1.

  @01.0a0#0,54321

- state ack command with delimiter text enabled.

  @01.0a3#2,1opr,0sim,54321

- state ack command with delimiter text disabled.

  @01.0a3#2,1,0,54321

- unit 1 go to operate command (goes to operate from a standby or paused state).

  @01.0a1#1,1,54321

- unit 1 pause command (pauses a timed cycle – RTC or ATC).

  @01.0a1#1,2,54321

Notes:

1. Blank fields are ignored so whatever setting is currently active for that field will still be active after a command with a blank field.
2. A command type of 1 (set) is only allowed if the power supply is in remote mode as indicated by the RMT indicator on the front panel (and as indicated by the local/remote field in the readings “d” command).
3. The operate and remote switch functionality when in the remote mode will depend on the settings in the User Settings command.
4. Set the operate state to ‘pause’ to temporarily stop a cycle and then set the operate state to ‘operate’ to resume the cycle.
5. Changing the operate state to ‘standby’ will end the current cycle (or clear the EOC state if it was active). Changing the operate state to ‘operate’ will resume a paused cycle. Changing the operate state to ‘operate’ will start a new cycle if the current cycle is not running and is not paused.
6. If simulation mode is active the supply output is disabled. In operate mode the read backs are simulated based on the settings and a simulated load. The simulated load size is computed to allow maximum supply output. The supply will simulate current and voltage regulation as well as

cross over points. Simulation mode is indicated on the supply front panel by a flashing operate lamp when in operate mode. Simulation mode is indicated in the readings “d” command by the supply state parameter.

7. The simulation state cannot be changed if the operate state is set to (1) operate. If the current operate state is (1) operate, then the state command must be used to change the operate state to standby and then a separate instance of the state command can be sent to change the simulation state.

B.1.14 Readings Command “d”:

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (0 to 2; 0 is a global channel)	
d0	Command character and Type – 0=read, 1=set(n/a), 2=activate(n/a), 3=ack, 4=nak	
#12,	Number of fields character and number of fields after the comma, excluding CRC	
1,	supply state – 0=standby, 1=operate, 2= pause (cycle is paused and output is disabled)	opr
1,	Local/Remote state – 0 = local, 1 = remote,	rem
8.2,	average forward current – amps	afi
10.23,	average forward voltage – volts	afv
0,	Regulation – 0 = not regulating (no output), 1 = voltage, 2 = current	reg
2,	XTC Mode (0=manual, 1=RTC, 2=ATC)	xc
20.5,	XTC Reading – Amp time or Real time remaining in the currently running ATC or RTC cycle - units are dependent on the XTC settings in the setup command	xtot
1234,	Totalizer Value – units are dependent on the totalizer settings in the setup command	tot
75,	Cooling Fan Speed – 0 to 100%	fdty
35,	Heat Sink Temperature – degrees C (65535 if there is an error with the sensor, an error code will also be reported in the alarm status command “m”)	tmp
0,	Status Flags Bit 0 = End of Cycle (1 = End of Cycle) Bit 1 = Low Bus Voltage (1 = Low bus voltage, probable primary power loss) Bit 2 = Output Inhibit (1= hardware interlock is active, front panel inhibit LED is on) Bit 3 = Simulation Mode (1 = Simulation Mode is active) Bits 4 to 15 Reserved for future use	stf
0,	alarm flag – 0 = no alarms, 1 = one or more alarm codes have not been read (see the alarm status command “m”)	alrm
CRC	CRC value in ascii decimal	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Readings Command: (cont.)

Examples of Readings Command:

- read readings command from unit 1.

  @01.0d0#0,54321

- ACK readings command with text delimiters.

@01.1d3#12,1opr,1rem,8.2afi,10.23afv,1reg,2xc,10.25xtot,1234tot,75fdty,35tmp,1stf,0alrm,54321

Notes:

1. The usable resolution of any value is limited to the accuracy and precision of the power supply as indicated in the power supply manual.
2. A non-zero error flag indicates errors are present. Use the error status message “m” to determine which errors are present.
3. Using the global unit address (00) has no affect, no response is sent to commands directed to the global unit address.
4. The error flag is set as soon as any active errors are set by the LT controller. This flag will remain set (1) until the error or errors are read using the error status command “m”. This flag does not indicate that errors are currently active, only that errors have been set and have not be read since they were set. To track currently active errors the error status command “m” should be used any time the error flag is set in the readings command.
5. See the host State command “a” for more information on simulation mode.

B.1.15 Error Status Command “m”:

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0)	
m0	Command character and Type – 0=read, 1=set(n/a), 2=activate(n/a), 3=ack, 4=nak	
#5,	Number of fields character and number of fields after the comma, excluding CRC (variable)	
0,	Error number (0 to 255)	err
1,	Error number (0 to 255)	err
2,	Error number (0 to 255)	err
33,	Error number (0 to 255)	err
35,	Error number (0 to 255)	err
CRC	CRC value in ascii decimal	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Examples of Error Status Command:

- read error status command from unit 1.

  @01.0m0#0,54321

- ACK error status command with 3 errors and delimiter text enabled.

  @01.0m3#3,12err,16err,55err,54321

- ACK error status command with 7 errors and delimiter text disabled.

  @01.0m3#7,5,7,9,10,22,23,28,54321

- ACK error status with no errors set

  @01.0m3#0,54321

Notes:

1. Errors stay in the error status buffer until read, then they are removed, unless the error source is still active. Errors reported by the error status command are errors that have been set since the last time the error status command was sent by the host. The errors reported may or may not currently be active. To maintain a list of currently active errors the error status command should be issued any time the error flag in the readings command “d” is set to one. The error status command will report active errors until they clear AND the error status command is issued. For example, if error number 10 is active the error flag in the readings command will be set to one. The error status command will report error 10 each time it is requested, it will not be removed from the error status buffer until it clears. Once error 10 clears the next read of the error status will remove error 10 from the buffer.
2. This is a variable length message, dependent on the number of errors in the error status buffer.
3. Use the table of errors to determine what each error code means.
4. The channel ID ‘a’ should always be zero.

B.1.16 Error History Command “h”:

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a (n/a, set to zero)	
h0	Command character and Type – 0=read, 1=set(n/a), 2=activate(n/a), 3=ack, 4=nak	
#6,	Number of fields character and number of fields after the comma, excluding CRC (variable)	
12,	Error number (0 to 255)	err
1,	Occurance Count (1 to 255)	occ
12123,	Time stamp of last occurrence in minutes (0 to 65535)	min
26,	Error number (0 to 255)	err
4,	Occurrence Count (1 to 255)	occ
12125,	Time stamp of last occurrence in minutes (0 to 65535)	min
CRC	CRC value in ASCII decimal	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Examples of Alarm Status Command:

- read alarm status command from unit 1.
  @01.0h0#0, 54321
- ACK alarm status command with default text delimiters.
  @01.0h3#9,12err,1occ,12125min,27err,5occ,12125min,29err,255occ,12128min, 54321
- ACK alarm status command with comma delimiters.
  @01.0h3#3,12,1,12125, 54321

Notes:

1. This is a variable length message, dependent on the number of errors in the error history.
2. The error history is not an indication of active error codes, use the error status “m” command to determine active error codes.
3. Not all errors are logged to the error history, see the list of error codes for details regarding which error codes are logged.
4. The error history information is preserved through power cycles.
5. There is a limited space to store errors in the error history. Only the most recent errors are stored. Once the error history is full the oldest errors are overwritten.
6. The time stamp of the last occurrence of the error is derived from the total system on time minutes. The logged time stamp has a maximum value of 65535 minutes. The time stamp contains the 16 least significant bits of the total system on time. As such every 1092 hours of operation the time stamp logged will roll over to zero.
7. The channel ID ‘a’ should always be zero.

B.1.17 User Settings Command “t”:

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0)	
t0	Command character and Type – 0=read, 1=set, 2=activate(n/a), 3=ack, 4=nak	
#19,	Number of fields character and number of fields after the comma, excluding CRC	
1,	unit address – 1 to 99, (unit address used in the header of each command)	addr
0,	Host port baud rate – 0 = 9600 (default), 1 = 19200, 2 = 38400, 3 = 57600, 4 = 115200	bps
0,	Power Up Mode – 0 = always start in standby, 1 = return to last state	pwr
	Power Fail Error Enable - 1 = enable power failure errors, 0 = disable power failure errors. There is a separate error code for a brief power failure (error code 103) that did not cause a complete power loss but did disable the output, and a complete power loss (error code 102).	pf
0,	Front panel operate switch enable (0 = locked, 1 = enabled)	opsw
0,	Front panel remote switch enable (0 = locked, 1 = enabled)	rmsw
1,	Default current setting source in remote mode CH1 (0 = host, 1 = option card, 2 = standard analog input (not implemented)). This determines the default (at power on) source of the ch1 current setting while in remote mode.	isrc
1,	Default current setting source in remote mode CH2(0 = host, 1 = option card, 2 = standard analog input (not implemented)). This determines the default (at power on) source of the ch2 current setting while in remote mode.	isrc
1,	Default voltage setting source in remote mode CH1 (0 = host, 1 = option card, 2 = standard analog input (not implemented)). This determines the default (at power on) source of the ch1 voltage setting while in remote mode.	vsrc
1,	Default voltage setting source in remote mode CH2 (0 = host, 1 = option card, 2 = standard analog input (not implemented)). This determines the default (at power on) source of the ch2 voltage setting while in remote mode.	vsrc
0,	Clear Active Errors (0 = no action, A numeric value clears the associated error code, 32767 clears all active error codes). If the error conditions still exists after an error code is cleared the error code will be set again. The action of setting this parameter to a non-zero number clears the associated alarm, the value of this parameter is not stored and will always be read as zero.	eclr
0,	Clear Totalizer CH1 (0 = no action, 1 = set totalizer value to zero) The action of setting this parameter to ‘1’ clears the totalizer, the value of this parameter is not stored and will always be read as zero.	tclr
0,	Clear Totalizer CH2 (0 = no action, 1 = set totalizer value to zero) The action of setting this parameter to ‘1’ clears the totalizer, the value of this parameter is not stored and will always be read as zero.	tclr

0,	Digital Input Enable(start) Action – 0 = no action, 1 = start a new cycle; When set to '1' a cycle will always start running (either resume the currently paused cycle or start a new one) when the digital input transitions such that the output is enabled (inhibit LED turns off).	dst
0,	Digital Input Disable(stop) Action – 0 = pause the current cycle when the digital input disables the output (inhibit LED turns on), 1 = end the current cycle when the digital input disables the output (inhibit LED turns on).	dsp
0,	Front Panel Run Screen Select CH1 – 0 = meters, 1 = totalizer status, 2 = cycle status, 3 = heat sink temperature in degrees C, 4 = heat sink temperature in degrees F, 5 = fan speed (note that the end of cycle message "EOC" will be displayed at the end of a cycle regardless of the currently selected run screen, use the state command "a" with an operate state of standby to clear the EOC message)	scr
0,	Front Panel Run Screen Select CH2 – 0 = meters, 1 = totalizer status, 2 = cycle status, 3 = heat sink temperature in degrees C, 4 = heat sink temperature in degrees F, 5 = fan speed (note that the end of cycle message "EOC" will be displayed at the end of a cycle regardless of the currently selected run screen, use the state command "a" with an operate state of standby to clear the EOC message)	scr
0,	Front Panel Error Message Disable – 1 = Disable display of error codes on the front panel, 0 = enable display of error codes on the front panel (the fault lamp is active regardless of this setting, if the error messages are disabled (0) then the fault lamp will flash on and off when a new error code is set). This setting is not retained through a power cycle and defaults to 0 at power up.	edis
0,	Front Panel Unit Configuration Password (code) – 0 to 9999. This is the code that needs to be entered from the front panel to access the unit configuration menu. If the code is known it can also be changed from the front panel within the unit configuration menu. The default code from the factory is 0000. This serial command does not require the existing code to be known, it is the responsibility of host application to protect this password and keep in hidden if desired.	pswd
CRC	CRC value in ascii decimal	
crlf	Carriage return and Line feed (0x0D 0x0A)	

Examples of User Settings Command:

- read user settings command from unit 1.
  @01.0t0#0,54321
- ack read user settings command with text delimiters.
  @01.0t3#19,01addr,3bps,0pwr,1pf,1opsw,1rmsw,2isrc,2isrc,2vsrc,2vsrc,0eclr,0tclr,0tclr,
  0dst,1dsp,0scr,0scr,0edis,0pswd,54321
- ack read command with comma delimiters.
  @01.0t3#19,01,3,0,1,1,1,2,2,2,2,0,0,0,1,0,0,0,0,0,54321

- set baud rate to 19200 (note the ACK response from this command will be sent at the original baud rate, the baud rate change occurs after the ACK to this command)
  @01.0t1#2,,1,54321

Notes:

1. All user settings are stored in non-volatile memory and will be retained through a power cycle.
2. The unit address must be set using the global address on a single drop bus unless the address of the unit is known. Optionally it is possible to set the host port communications settings to the desired values from the front panel. See 6.3.2.Host Port Configuration.
3. If the power up mode is set to 1 and the unit was powered down in operate mode, then the unit will display a count down when it powers up. If no action is taken the unit switches to the operate state when the countdown expires. If the operate/standby switch is pressed at any point prior to the countdown expiration the countdown will terminate and the unit will remain in standby mode. If the host requests (using the state command) operate or standby prior to the countdown expiration the countdown is terminated and the requested mode is set.
4. The default current and voltage setting source in remote mode are where the current and voltage settings will come from by default when the unit is in remote mode. Changing the default source does not immediately affect the existing source of the setting in remote mode, it only affects what the source of the setting in remote mode will be by default at power up. The existing source of the settings in remote mode can be changed at any time using the setup ‘s’ command.
5. The channel ID ‘a’ should always be zero.
6. The channel 2 settings are only applicable in units with two channels.
7. Each time the unit configuration password is changed with this command the value is written to non-volatile memory. Periodic writes to this value could result in premature failure of the associated memory device. Leave this field blank unless the code needs to be changed. All other parameters in this command that are stored to non-volatile memory are written to non-volatile memory at power down and can be safely changed at periodic intervals.

B.1.18 Unit Info Command “u”:

@AA.a	Sync character (@) and unit address, AA = Unit ID (0 to 99; 0 is a global ID), a = Channel ID (always 0)	
u0	Command character and Type – 0=read, 1=set(n/a), 2=activate(n/a), 3=ack, 4=nak	
#24,	Number of fields character and number of fields after the comma, excluding CRC	
00,	Model Type Start model types start at 20. 20 = 1200W, 21 = 36kW	mdl
0123456,	serial number – 01 is 2 digit year, 234 is day of year, 56 is unit build count	sn
750,	Amp Rating – amps	fir
750,	Volt Rating – volts	fvr
750,	Amp Rating – amps (second channel, if present)	fir
750,	Volt Rating – volts (second channel, if present)	fvr
6000,	unit on time – minutes	ton
3000,	unit operate time – minutes	topr
12345,	Unit amp hours ch1	ahr
0,	Unit amp hours ch2	ahr
3,	LT control panel firmware major version number – 0-255 [in PT# 200-1458-V301 the major version number is 3]	av1
0,	LT control panel firmware minor version number – 0-255 [in PT# 200-1458-V301 the minor version number is 1 (01)].	av2
1,	LT control panel firmware revision number – 0-255 [the revision is not part of the part number]	av3
6,	LT Boot loader major version number – 0-255 [in PT# 200-0458-V601 the major version number is 6]	bv1
0,	LT Boot loader minor version number – 0-255 [in PT# 200-0458-V601 the minor version number is 1 (01)]	bv2
1,	LT Boot loader revision number – 0-255 [the revision is not part of the part number]	bv3
200,	LT control panel firmware part number class [in PT# 200-1458-V301, the class is 200]	ap1
1458,	LT control panel firmware part number type [in PT# 200-1458-V301, the type is 1458]	ap2
301,	LT control panel firmware part number version [in PT# 200-1458-V301 the version is 301]	ap3
200,	LT boot loader firmware part number class [in PT# 200-0458-V601, the class is 200]	bp1

458,	LT boot loader firmware part number type [in PT# 200-0458-V601, the type is 0458]	bp2
601,	LT boot loader firmware part number version [in PT# 200-0458-V601, the version is 601]	bp3
2,	Host protocol major version number	pv1
0,	Host protocol minor version number	pv2
CRC	CRC value in ascii decimal	
Crlf	Carriage return and Line feed (0x0D 0x0A)	

Unit Info Command: (cont.)

Examples of Unit Command:

- read unit command.
  @01.0u0#0,54321
- ACK read unit command with default descriptor text delimiters.
  @01.0u3#22,20mdl,712647sn,100fir,12fvr,0fir,0fvr,112245ton,9864topr,1234ahr,0ahr,3av1,0av2,0av3,
  3bv1,1bv2,2bv3,200ap1,1458ap2,300ap3,200bp1,458bp2,301bp3,54321

Notes:

1. Values that do not apply to a unit can be blank or zero (for example, the second channel ratings on a single channel supply).
2. The channel ID ‘a’ should always be zero.

Appendix C: Error Codes

When a fault conditions occurs the FAULT lamp on the front panel illuminates. The display will switch back and forth between the normal read back meters and an error code. If multiple error codes are active each active error code is displayed one at a time until all active error codes have been displayed. See 6.5.Error Messages for more details regarding the display of error codes. The following is a list of possible error codes.

NOTE: The error history information can be viewed using the host port. See B.1.16Error History Command "h": for more information.

Error Code	1.2kW	36kW	Fault Description	Corrective Action	Output Inhibited	Logged to Error History
1	X	X	DSP detects brownout caused a reset	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
2	X	X	DSP detects a watch dog timeout caused reset	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
3			N/A	N/A	N/A	N/A
4	X	X	DSP detects a reset because of the MEM CLR line	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
5	X	X	DSP illegal op code trap	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
6	X	X	DSP trap conflict trap	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
7	X	X	DSP oscillator fail trap	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
8	X	X	DSP address error trap	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
9	X	X	DSP stack overflow or underflow trap	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
10	X	X	DSP math errror trap	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
11	X	X	DSP DMA error trap	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
12	X	X	control was passed to an unused interrupt vector	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
13			N/A	Cycle power. If fault continues report to Dynatronix, Inc.	N/A	N/A
14	X	X	N/A	N/A	NO	YES
15	X	X	N/A	N/A	NO	YES
16	X		N/A	N/A	NO	YES
17	X	X	Invalid checksum in user EEPROM, or an error writing to user EEPROM.	Cycle power. All user settings will be set to default values. If the fault continues there could be a component failure.	YES	

18	X	X	Invalid checksum in configuration EEPROM	Cycle power. All factory configuration settings are set to default values, unit may not operate correctly. There could be a component failure. Contact Dynatronix.	YES	YES
19	X	X	I2C bus communications error with EEPROM	Cycle power. If fault continues report to Dynatronix, Inc.	YES	YES
20		X	The initialization sequence did not complete without errors	Cycle power. If fault continues report to Dynatronix, Inc.	YES	YES
21	X	X	Voltage setting is outside of the power supply ratings.	Cycle power. The setting will be changed to zero. Adjust the setting to the desired value.	YES	NO
22	X	X	Voltage setting is outside of the power supply ratings.	Cycle power. The setting will be changed to zero. Adjust the setting to the desired value.	YES	NO
23	X	X	Current setting is outside of the power supply ratings.	Cycle power. The setting will be changed to zero. Adjust the setting to the desired value.	YES	NO
24	X	X	Current setting is outside of the power supply ratings.	Cycle power. The setting will be changed to zero. Adjust the setting to the desired value.	YES	NO
25	X	X	The displayed current could not be auto-ranged for proper display and may be truncated.	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
26	X	X	The displayed current could not be auto-ranged for proper display and may be truncated.	Cycle power. If fault continues report to Dynatronix, Inc.	NO	YES
27		X	N/A	N/A	N/A	N/A
28		X	N/A	N/A	N/A	N/A
29		X	N/A	N/A	N/A	N/A
30		X	N/A	N/A	N/A	N/A
31		X	N/A	N/A	N/A	N/A
32		X	N/A	N/A	N/A	N/A
33			N/A	N/A	N/A	N/A
34			N/A	N/A	N/A	N/A
35		X	N/A	N/A	N/A	N/A
36		X	N/A	N/A	N/A	N/A
37		X	N/A	N/A	N/A	N/A
38		X	N/A	N/A	N/A	N/A
39		X	N/A	N/A	N/A	N/A
40		X	N/A	N/A	N/A	N/A
41			N/A	N/A	N/A	N/A
42			N/A	N/A	N/A	N/A
43		X	N/A	N/A	N/A	N/A
44		X	N/A	N/A	N/A	N/A
45		X	N/A	N/A	N/A	N/A
46		X	N/A	N/A	N/A	N/A
47		X	N/A	N/A	N/A	N/A

48		X	N/A	N/A	N/A	N/A
49		X	N/A	N/A	N/A	N/A
50		X	N/A	N/A	N/A	N/A
51		X	N/A	N/A	N/A	N/A
52		X	N/A	N/A	N/A	N/A
53		X	N/A	N/A	N/A	N/A
54		X	N/A	N/A	N/A	N/A
55		X	N/A	N/A	N/A	N/A
56			N/A	N/A	N/A	N/A
57		X	N/A	N/A	N/A	N/A
58		X	N/A	N/A	N/A	N/A
59		X	N/A	N/A	N/A	N/A
60		X	N/A	N/A	N/A	N/A
61		X	N/A	N/A	N/A	N/A
62		X	N/A	N/A	N/A	N/A
63		X	N/A	N/A	N/A	N/A
64		X	N/A	N/A	N/A	N/A
65		X	N/A	N/A	N/A	N/A
66		X	N/A	N/A	N/A	N/A
67		X	N/A	N/A	N/A	N/A
68		X	N/A	N/A	N/A	N/A
69		X	N/A	N/A	N/A	N/A
70		X	N/A	N/A	N/A	N/A
71	X	X	The model type in the LT controller EEPROM has not been set (Model Type = 0xFF)	Cycle power. If fault continues report to Dynatronix, Inc.	YES	NO
72	X		Fan circuit drawing more current than expected. Possible locked rotor condition.	Check the fan for proper operation. Make sure the fan blades turn freely.	NO	YES
73	X		Over temperature sensor indicates a temperature greater than 70C. The over temperature lamp blinks on and off. The temperature sensor reading is alternately displayed with the normal display.	Change to standby mode (leave the power on so the fan continues to run) as soon as possible. The fault will clear when the unit cools down to 65C. Check the fan intake and output to ensure proper air flow.	NO	YES
74	X		Over temperature sensor indicates a temperature greater than 75 C. The over temperature lamp is on steady. The temperature sensor reading is alternately displayed with the normal display.	The unit will automatically change to standby mode to avoid damage. Leave the unit running so the fan can cool it down. The fault will clear when the unit cools down to 65C. Check the fan intake and output for proper air flow.	YES	YES

75	X		The temperature sensor value is outside the valid range of temperatures. Failed temperature sense circuit or unit is located in an environment where the ambient temperature is outside the recommended temperature range.	Verify that the rectifier is located where ambient temperatures do not exceed the recommended temperature range. Power off the rectifier and allow it to return to ambient temperature. If fault re-occurs report the condition to Dynatronix.	YES	YES
76	X		Modules detected at power up do not match the module configuration stored in EEPROM	There is either a problem with the configuration, or the incorrect power modules have been installed.	YES	NO
77	X		One or more calibration values could not be stored to EEPROM.	Re-calibrate. If the fault persists contact Dynatronix.	NO	YES
78		X	N/A	N/A	N/A	N/A
79	X	X	N/A	N/A	N/A	N/A
80	X	X	N/A	N/A	N/A	N/A
81		X	N/A	N/A	N/A	N/A
82		X	N/A	N/A	N/A	N/A
83		X	N/A	N/A	N/A	N/A
84		X	N/A	N/A	N/A	N/A
85		X	N/A	N/A	N/A	N/A
86		X	N/A	N/A	N/A	N/A
87		X	N/A	N/A	N/A	N/A
88		X	N/A	N/A	N/A	N/A
89		X	N/A	N/A	N/A	N/A
90		X	N/A	N/A	N/A	N/A
91		X	N/A	N/A	N/A	N/A
92		X	N/A	N/A	N/A	N/A
93		X	N/A	N/A	N/A	N/A
94	X	X	Current over tolerance alarm (CH1). The difference between the current reading and the current setting on CH1 exceeded the tolerance setting (reading greater than the current setting).	Out of tolerance alarms self clear at the start of a new cycle. Optionally out of tolerance alarms can be manually cleared at any time, but will be set again if the condition persists.	NO	YES
95	X	X	Current over tolerance alarm (CH2). The difference between the current reading and the current setting on CH2 exceeded the tolerance setting (reading greater than the current setting).	Out of tolerance alarms self clear at the start of a new cycle. Optionally out of tolerance alarms can be manually cleared at any time, but will be set again if the condition persists.	NO	YES
96	X	X	Current under tolerance alarm (CH1). The difference between the current reading and the current setting on CH1 exceeded the tolerance setting (reading less than the current setting).	Out of tolerance alarms self clear at the start of a new cycle. Optionally out of tolerance alarms can be manually cleared at any time, but will be set again if the condition persists.	NO	YES
97	X	X	Current under tolerance alarm (CH2). The difference between the current reading and the current setting on CH2 exceeded the tolerance setting (reading less than the current setting).	Out of tolerance alarms self clear at the start of a new cycle. Optionally out of tolerance alarms can be manually cleared at any time, but will be set again if the condition persists.	NO	YES

98	X	X	Voltage over tolerance alarm (CH1). The difference between the voltage reading and the voltage setting on CH1 exceeded the tolerance setting (reading greater than the voltage setting).	Out of tolerance alarms self clear at the start of a new cycle. Optionally out of tolerance alarms can be manually cleared at any time, but will be set again if the condition persists.	NO	YES
99	X	X	Voltage over tolerance alarm (CH2). The difference between the voltage reading and the voltage setting on CH2 exceeded the tolerance setting (reading greater than the voltage setting).	Out of tolerance alarms self clear at the start of a new cycle. Optionally out of tolerance alarms can be manually cleared at any time, but will be set again if the condition persists.	NO	YES
100	X	X	Voltage under tolerance alarm (CH1). The difference between the voltage reading and the voltage setting on CH1 exceeded the tolerance setting (reading less than the voltage setting).	Out of tolerance alarms self clear at the start of a new cycle. Optionally out of tolerance alarms can be manually cleared at any time, but will be set again if the condition persists.	NO	YES
101	X	X	Voltage under tolerance alarm (CH2). The difference between the voltage reading and the voltage setting on CH2 exceeded the tolerance setting (reading less than the voltage setting).	Out of tolerance alarms self clear at the start of a new cycle. Optionally out of tolerance alarms can be manually cleared at any time, but will be set again if the condition persists.	NO	YES
102	X	X	A complete power failure occurred while the unit was in operate mode. The output was disabled for an unknown period of time (while the power was off). This error code is only reported if power failure alarms are enabled.	Power failure alarms must be manually cleared. Once a power failure alarm is set it will remain active (even through multiple power on/off cycles) until it is manually cleared.	NO	YES
103	X	X	Power was temporarily lost and then recovered before a complete shutdown occurred. Power was lost and the output was disabled until power was recovered. The period of time that the output was disabled depends on how long power was lost, but was not more than the maximum amount of time the supply controls can remain active after primary power has been lost. Note that if this fault is set in combination with error 102 then the total amount of time that the output was disabled cannot be determined since error 102 indicates a complete loss of power where the controls are no longer active. Error 102 and 103 can occur together when primary power is lost and recovered multiple times at various intervals. This error code is only reported if power failure alarms are enabled.	Power failure alarms must be manually cleared. Once a power failure alarm is set it will remain active (even through multiple power on/off cycles) until it is manually cleared.	NO	YES

Revision History

Rev	Description	ECO	Date	Initials
01	Start with 198-0853-01 dated 01-28-2009 and make updates to support firmware v3.00		03/11/09	MRT
A	Production Release – No changes from rev -01	3812	2/11/10	MAH
B	Update per CO 4314	4314	10/12/11	NPK
C	Update fonts per CO 4344	4344	10/24/11	NPK
D	Update Contact info	4581	9/21/2012	MRT
E	Update fault code #75 description to indicate output is disabled (starting in firmware v03.02.00)	4586	9/21/2012	MRT
F	Minor corrections in Section 4	REL 1036	3/15/13	BGH

THIS DOCUMENT IS THE PROPERTY OF DYNATRONIX INC AND MAY NOT BE REPRODUCED OR USED IN ANY MANNER WIHTOUT PERMISSION OF DYNATRONIX INC.